

THE NAVY'S ENERGY & ENVIRONMENTAL MAGAZINE

Currents

winter 2015

F/A-18 PROGRAM Explores the Use of **Exhaust Nozzle** **CHEVRONS** to Reduce ENGINE NOISE

Innovation Demonstrates
Proactive Acquisition
Program Management by
Fighter Jet Team

Spray Aeration Improves San Clemente Island Drinking Water
JBPHH Joins the Team to Fight Coconut Rhinoceros Beetle
Hawaii Takes to the Air for Oil Spill Response

ENERGY
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INSIDE!



THE NAVY'S ENERGY & ENVIRONMENTAL MAGAZINE **Currents**

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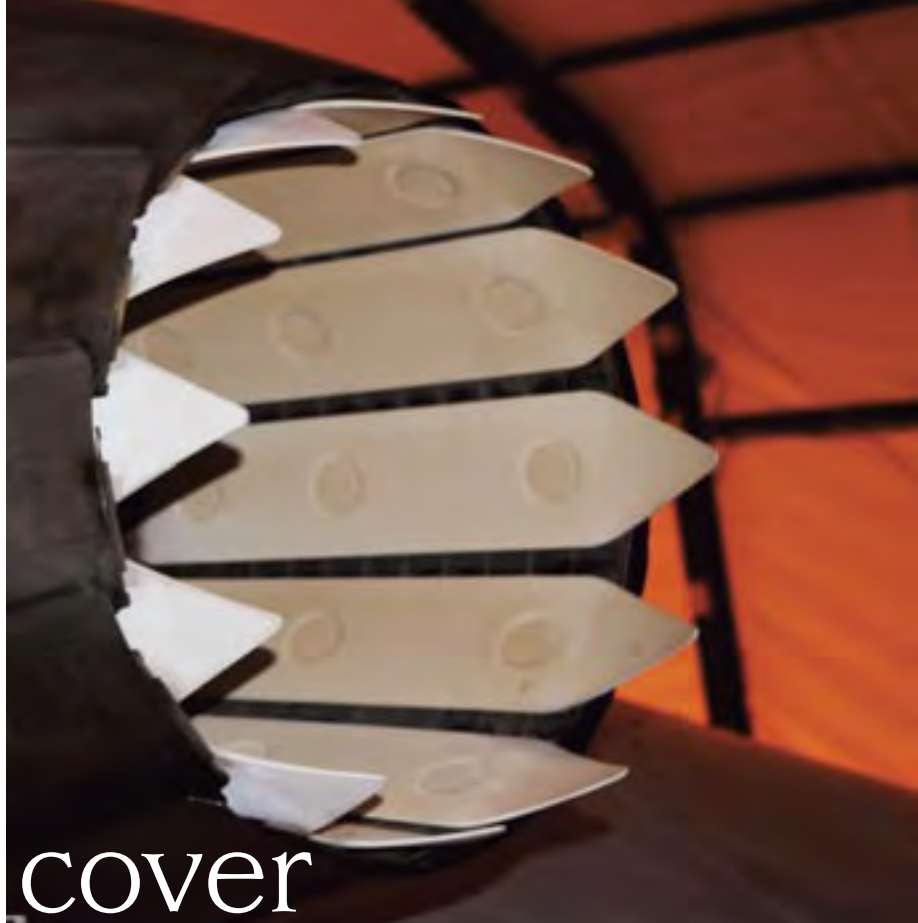
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cover

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Improving Awareness of Energy & Navy At-Sea Activities

WELCOME TO THE winter 2015 issue of *Currents*. I'll use this space to give a short overview of recent Navy accomplishments in our energy program, as well as some noteworthy environmental items.

This past November, I participated in a Fleet Energy Training event hosted by U.S. Fleet Forces Command (USFF) at Naval Air Station Jacksonville. It was the third event of this type, and I believe the best one to date. There were 270 participants and a great turnout by senior leadership from USFF and all of their Type Commanders. Among the many informative speakers were the Honorable Dennis McGinn, Assistant Secretary of the Navy for Energy, Installations and Environment; Rear Admiral Brad Gehrke, Director of Maritime Headquarters for USFF; and Rear Admiral Mary Jackson, Commander Navy Region Southeast. These forums provide a great opportunity to highlight the importance and purpose of the Navy's energy program as well as to share/discuss new ideas and best practices throughout the Fleet to turn ideas into useful outcomes. For Sailors and other attendees, these training events reinforce the fact that we are undertaking energy initiatives because more efficient use of fuel provides increased combat capability and more time on station. Likewise, alternative fuels provide greater flexibility and resiliency to our logistics chain. Additional training events are being scheduled in Hawaii and Japan early in 2015.

saving practices. We're already thinking about how to make the next version more interactive and as engaging as possible to help harness the innovative ideas of our Sailors and civilians. If you haven't downloaded it yet, get EW for free and send us your ideas at <http://greenfleet.dodlive.mil/energy/energywarrior>.



With 2014 now in the rear view mirror, planning is ramping up for deployment of the Great Green Fleet (GGF) in 2016. The GGF deployment will differ from the historic journey of the Great White Fleet in that, rather than a specific "battle group" that navigates a planned route worldwide, the GGF will involve assets in many locations performing planned exercises and deployments while using alternative fuels (i.e., biofuel blends or nuclear) and/or a combination of energy conservation measures such as stern flaps and energy dashboards or operational procedures that maximize the efficient use of energy/fuel. As with other facets of our energy programs, individual behavior and cultural change is key as

These training events reinforce the fact that we are undertaking energy initiatives because more efficient use of fuel provides increased combat capability and more time on station.

One of the awareness tools USFF and I highlighted at the Jacksonville training was the Energy Warrior (EW) app. The app has been available for iPads and Android devices since mid-September, but we recently completed an update that makes it work on iPhones as well. USFF personnel did a great job introducing the app, and many attendees—including a reporter from Action News Jax (WJAX-TV)—downloaded it on the spot. We continue to get requests from participants regarding the app and others offering technology ideas and innovative energy-

we highlight these initiatives during GGF as "the new normal" to increase our capability and resiliency.

Interoperability with our allies will also be a vital aspect of the GGF for many reasons and we intend to invite our international partners to participate. We and our partners must have full assurance that any alternative fuels supplied to our ships and aircraft meet required military specifications (MILSPEC), which is what our test and qualification program for fuels achieves. Once qualified, our MILSPECS

for fuel are updated to reflect that these new fuels meet military standards. We currently have statements of cooperation in place with the Royal Australian Navy (July 2012) and the Italian Navy (April 2014) to facilitate cooperation on research, testing, and use of advanced biofuels, and are pursuing similar agreements with other allies. Additionally, the North Atlantic Treaty Organization fuels and lubricants working group is working with partner nations to adopt alternative fuels.

ship's crews because of better light quality, much longer bulb life which greatly reduces maintenance requirements, as well as improving safety as bulbs in hard to change locations do not have to be replaced as frequently. We're getting positive feedback from ships with LEDs installed and have plans to install more in the future.



As of the end of 2014, the Naval Sea Systems Command and the Fleets have installed approximately 185,000 LED bulbs on 190 ships.

On the shore energy front, our installations continue to be recognized for their innovative efforts to reduce energy consumption. During a ceremony on 31 October 2014 at the White House, the Navy received two of the seven 2014 GreenGov Presidential Awards. These awards recognize organizations and individuals that excel in pursuing clean energy goals outlined in executive order 13514 (Federal Leadership in Environmental, Energy, and Economic Performance). The energy team at Naval District Washington was recognized for reducing energy intensity by 25 percent relative to a 2003 baseline, reducing water intensity by 13 percent from the 2007 baseline, and completing 99 percent of advanced metering infrastructure installation. Located in an extremely challenging climate with base power provided solely by generators, the Camp Lemonnier (Djibouti, Africa) energy team reduced energy intensity by 13.5 percent relative to the 2003 baseline by making efficiency upgrades to generators, power plants, air conditioning units, and chilled water stations. Especially in areas like Djibouti, efforts to reduce water and fuel usage with no mission impact can be a huge cost saver and helps reduce challenging logistics burdens. Congratulations to these two commands for this well-deserved recognition.

In my last column, I mentioned progress in accelerating installation of light emitting diode (LED) bulbs on ships. I'm happy to report that as of the end of 2014, the Naval Sea Systems Command and the Fleets have installed approximately 185,000 LED bulbs on 190 ships, including amphibious ships, cruisers, destroyers, and Military Sealift Command ships. LEDs save energy, which is important for reasons I've outlined above, but they also have a very positive impact on the quality of life for

We are always looking for opportunities to highlight our environmental stewardship and educate the public about how and why we train and test, the steps we take to protect marine mammals and the environment, and the research we're funding to improve knowledge on how marine mammals are affected by underwater sound. In support of those goals, USFF recently provided an opportunity for key representatives from the Marine Mammal Commission, the National Oceanic and Atmospheric Administration, the Bureau of Ocean Energy Management, and Woods Hole Oceanographic Institution (a non-profit oceanic research organization) to embark aboard the aircraft carrier USS Theodore Roosevelt (CVN 74). This was a rare chance for non-military folks to see their Navy in action, talk to Sailors, and better understand the complexity of how we live and operate at sea. After the carrier visit, several guests participated in a pier side visit to the destroyer USS McFaul (DDG 74). They received briefings on the marine mammal protective measures we use at sea, the marine mammal awareness training shipboard personnel receive, and our systems for safely managing biodegradables and other waste materials while minimizing impacts on the environment. While it is no small task to organize these types of ship visits, I believe they are among the most effective means to provide an accurate picture of our environmental programs and stewardship.

Thanks for reading *Currents*, and for your continued interest in and support of the Navy's energy and environmental initiatives. ⚓

Rear Admiral Kevin R. Slates
Director, Chief of Naval Operations Energy and
Environmental Readiness Division



A close-up photograph of the exhaust nozzle of an F/A-18 fighter jet. The nozzle is dark and metallic, with several white, chevron-shaped nozzles attached to the rear. The background is a warm, orange-red color, possibly from the engine's exhaust or a hangar light. The text is overlaid on the top half of the image.

F/A-18 PROGRAM Explores the Use of **Exhaust Nozzle** **CHEVRONS** to Reduce ENGINE NOISE

**Innovation Demonstrates Proactive Acquisition
Program Management by Fighter Jet Team**

Personnel from the F/A-18 and EA-18G Program Office (Program Manager—Air (PMA) 265) at the Naval Air Systems Command (NAVAIR) have been experimenting with the use of exhaust nozzle chevrons to reduce the noise generated by the Navy's preeminent strike fighter program.

Until very recently, the Navy's response to jet noise was focused exclusively on hearing protection.

BACKGROUND

For many years, tactical jet aircraft and jet engine designers have responded exclusively to the requirement for better performance and increased range by seeking greater jet engine thrust and lower aircraft weight. All acquisition programs establish performance goals and track the success of their systems design and modifications to that design against those goals. Greater thrust (a common goal for high performance tactical aircraft jet

engines) means increased exhaust velocity and higher temperatures, resulting in elevated jet noise. (For more insights, see our sidebar "The Navy Safety Center's Perspective on Noise & Its Impacts.") The Navy's solution (and that of other Services) to excessive noise has been to provide hearing protection (Flight Deck Cranials) for support personnel. Over the past years, the Navy has developed an Advanced Noise Reduction (ANR) system that promises the wearer up to 47 decibel (dB) protection.

Commercial jetliners with large high by-pass fan jet engines have achieved very significant jet noise reduction over the years. Unfortunately the thrust, weight, and size requirements peculiar to naval carrier aircraft preclude the use of this technology. Until very recently, the Navy's response to jet noise was focused exclusively on hearing protection. However, even the best ANR systems available do not provide adequate hearing protection. This gap in noise exposure must first be addressed at the source—the jet engine nozzle.

The Navy Safety Center's PERSPECTIVE ON NOISE & ITS IMPACTS

According to the Navy Safety Center's web site, noise is a fact of everyday life for the more than 107,000 Sailors living and working aboard U.S. Navy ships. In addition to flight operation noise, there are numerous noise sources on deck and throughout Navy ships that exceed safe limits for all but the shortest exposures. Long-term exposure to high levels of noise is a source of permanent hearing loss. Shipboard noise control is critical to the preservation of crew health, mission success, and personnel retention.

Noise-induced hearing loss is the Fleet's number one occupational health expense. The economic consequences to the Navy of hearing impairment include lost time and decreased productivity, loss of qualified workers through medical disqualification, military disability settlements, retraining, and expenses related to medical treatment, such as for hearing aids.

Disability payments to veterans for hearing loss show a continuing upward trend. Given the enormity of the increase in spending on hearing loss disability payments to former Navy personnel, it is important to find the sources of hearing loss in the Navy and then investigate ways to reverse this trend.

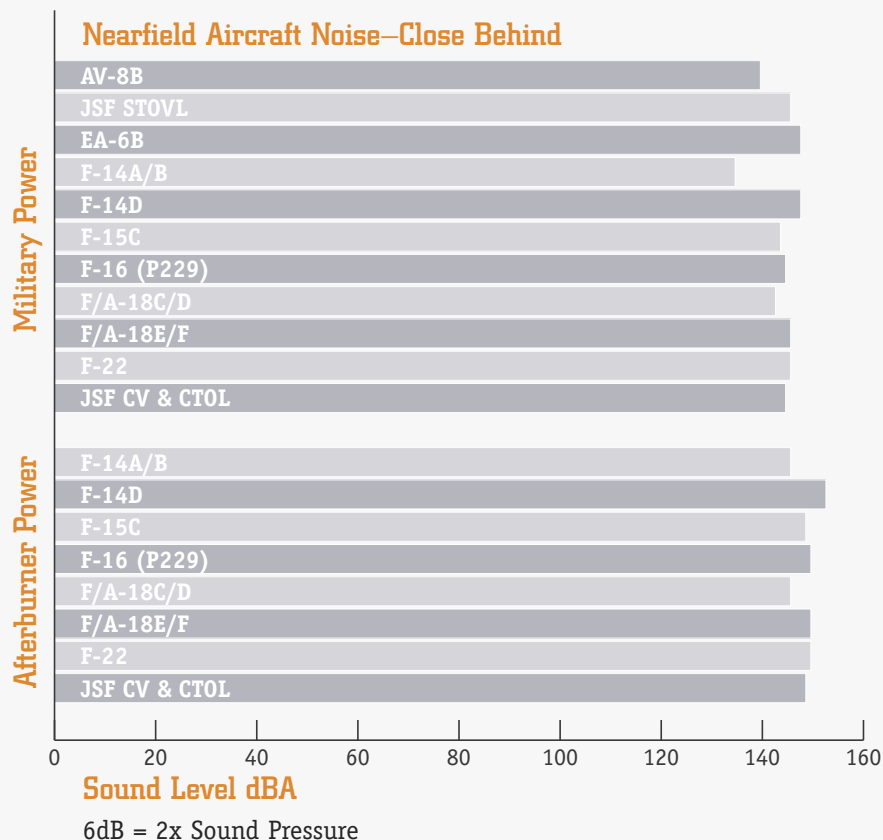
For more insights into the Navy Safety Center's efforts to control noise aboard Navy ships including a complete discussion of the problem of noise, its impact on the Navy's personnel and the need for action, visit www.public.navy.mil/comnavsafecen/pages/acquisition/noise_control.aspx.





THE PROBLEM

Nearfield Aircraft Noise—Close Behind



The Department of Defense and the Navy has for years recognized that hazards and risk associated with the operation of military platforms must be identified and mitigation measures put in place. The Defense Acquisition System Safety—Environment, Safety, and Occupational Health (ESOH) Risk Acceptance Memorandum (signed by Kenneth J. Krieg, Under Secretary of Defense for Acquisition, Technology and Logistics and dated 7 March 2007) states “I direct that addressees ensure that—prior to exposing people, equipment, or the environment to known system-related ESOH hazards—the associated risk levels, as defined in MIL-STD-882D, must be accepted by the authorities identified in DoDI 5000.2. The user representative must be part of this process throughout the lifecycle and must provide formal concurrence prior to all Serious- and High-risk acceptance decisions.”



Flight deck personnel are exposed to heavy acoustic loads.

The chevron static test conducted in 2007 demonstrated significant noise reduction without measured loss of thrust.

Jet noise can pose a serious risk. Pursuant to this memo, Program Executive Officer for Tactical Air (PEO(T)) formally acknowledged this and obtained concurrence from the Commander, Naval Air Forces (CNAF). Moreover, PEO(T) directed PMA265 to assess annually "...the viability of incorporating proven technologies into the F/A-18E/F and EA-18G." In response to this direction, PMA265 embarked on a robust research and development program.

THE SEARCH FOR A SOLUTION

PMA265 researched a number of technologies to reduce jet engine noise including corrugated seals, water injection, fluidic chevrons (air injection) and the application of plasma actuators to jet exhaust. Initially, each of these technologies showed promise but ultimately were not selected.

Corrugated Seals

The initial configuration of corrugated Variable Exhaust Nozzle (VEN) seals did reduce jet noise in the near field on takeoff but had an impact on

thrust when the aircraft was at altitude/cruise. This impacts aircraft range and speed—an unacceptable drawback for the Fleet and warfighter. PMA265 directed additional aeroacoustic research performed by the National Center for Physical Acoustics at the University of Mississippi which confirmed this analysis.

Water Injection

Water injection into the exhaust plume also reduces jet noise. However, there are many drawbacks. A massive brine plume when used on aircraft carriers leading to significant corrosion issues and carriage of a 4,000-pound water tank would greatly diminish aircraft range, performance, fuel and ordnance capability.

Fluidic Chevrons

Fluidic chevrons (injecting high pressure air jets into the exhaust plume) would seem to offer a "switchable solution"—use on takeoff and turn off at altitude/cruise. However during Office of Naval Research (ONR) tests, the



QUOTABLE QUOTES & SUPPORTING MEMORANDA

1. United States Fleet Forces Command
"This specific Rapid Technology Transition (RTT) F/A-18 Jet Noise Reduction Initiative is not only prudent, it is necessary for future Fleet readiness."

2. Naval Safety Center
"The Commander, Naval Safety Center enthusiastically supports efforts by the acquisition community to develop weapons systems with reduced noise signatures and this specific RTT F/A-18 jet noise reduction initiative."

3. Assistant Secretary of the Navy, Installations and Environment
"Succeeding generations of aircraft with their higher noise levels have only made this problem worse. Engineering solutions that reduce aircraft noise are key to resolving this problem."

4. Commander, Naval Air Forces
"The Commander, Naval Air Forces supports...this specific F/A-18 jet noise reduction initiative."



Chevrons installed on the F/A-18E/F aircraft in preparation for a static noise test.

compressed air demands far exceeded the available jet engine-produced bleed air available.

Plasma Actuators

Plasma actuators use a strong electrical field to generate plasma. This has the effect of reducing the turbulence and vortices in the exhaust plume thus reducing dB levels. However, electric power required is far above that available on board tactical aircraft.

Of the technologies and solutions tested, PMA265 determined that installing a uniquely shaped extension of the jet engine nozzles that may provide an optimal configuration for noise reduction.

THE PROPOSED TECHNOLOGY: Chevrons Extend the Variable Exhaust Nozzle Seals

The chevron is a specially designed shape that is installed at the trailing edge of the exhaust nozzle. The chevron promotes more rapid mixing in the shear layer between the jet plume and the ambient air through the generation of vortices that roll up along the angled side of the chevron. This enhanced mixing of the jet plume helps to reduce the peak jet velocity more efficiently. The peak jet velocity is the prime factor in noise generation—reduction in peak jet velocity equates to reduced noise production. This increased mixing

and reduction of peak velocity also reduces the extent and strength of the shock cells in the jet plume, which are known to generate noise through their interaction with the turbulent airflow.

CHEVRONS: The Best Solution to the Problem

The chevron static test conducted by ONR and General Electric (GE) Aviation at the Naval Air Warfare Center Aircraft Division (NAWCAD) in Lakehurst, New Jersey in September 2007 demonstrated significant noise reduction without measured loss of thrust. The reduction of exhaust noise on this first generation jet is an initial

continued on page 14



MC2 Laurie Dexter



MC2 Andrea Perez



MC1 Michael Lindsey



MC2 Andrea Perez





MC2 Andrea Perez



MC1 Michael Lindsey

The Navy's Blue Angels flight demonstration squadron flies F/A-18 aircraft. The exhaust nozzle chevrons discussed in this article are applicable to this entire class of aircraft.



MC2 Kathryn E. Macdonald

MC2 Andrea Perez





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step in integrating this commercial technology on military jet engines. The reduction of sound pressure levels by 3 dB A-weighted (dBA) over much of the frequency range is very significant as it represents a 50 percent reduction in sound pressure levels. This would be like doubling the distance from a noise source. Moreover, as generated in a subsequent test, in the 3 kilo hertz (kHz) to 6 kHz frequency, considered

to be the most likely to cause noise induced hearing loss (NIHL), noise reduction of up to 7 dB is possible. As discussed, other technologies such as corrugated seals, water injection, fluidic chevrons (air injection) and application of plasma actuators to jet exhaust are not as mature or as easy to implement as chevrons; hence the decision to focus on chevrons. Additionally, this design will serve as a foundation for further noise reduction because it is compatible with other noise abate-

ment technologies. This is a first step in an overall effort to reduce engine sound pressure level (SPL).

TEST PROGRAM: Demonstration & Validation

All changes in configuration of the F/A-18 aircraft can be made only after rigorous test and evaluation. The following major “pass/fail” criteria for chevron technology were applied to the F414 engine:

KEY PLAYERS

1. Program Office
The F/A-18 and EA-18G Program Office is responsible for acquiring, delivering and sustaining the F/A-18 C/D Hornet, F/A-18 E/F Super Hornet, and EA-18G Growler aircraft, providing naval aviators with capabilities that enable mission success. Serving seven international customers, the program office emphasizes cooperative development and partnerships for foreign military sales to Australia, Canada, Finland, Kuwait, Malaysia, Spain and Switzerland.

2. Contractor Support
The F/A-18 and EA-18G Program Office has relied on the original equipment manufacturer, GE Aviation to develop the initial sets of test article chevron VEN seals as they have the most complete understanding of the

required design/configuration of the F414 jet nozzle. To reduce the impact of the jet noise produced by F/A-18 aircraft on communities surrounding Naval Air Stations, the Program Office sponsored a Small Business Innovative Research contract awarded to Blue Ridge Research and Consulting. The goal of this contract was to develop a software program that would optimize the flight profiles minimizing noise impact. The final product called “The Optimizer” is available to the Naval Facilities Engineering Command for use at their activities. Although the configuration selected for development is chevrons, there are other designs that are potentially effective in reducing jet noise. The Program Office contracted with the University of Mississippi’s National Center for Physical Acoustics to explore these options and provide recommendations for additional research.

The Basics About THE F/A-18 HORNET JET FIGHTER

The F/A-18 Hornet was developed in the early 1980's as an all-weather aircraft and is used as an attack aircraft as well as a fighter. In its fighter mode, the F/A-18 is used primarily as a fighter escort and for Fleet air defense. In its attack mode, it is used for force projection, interdiction and close and deep air support. The Hornet saw its first combat action in 1986 during Operation El Dorado Canyon and subsequently participated in 1991 Operation Desert Storm and 2003 Operation Iraqi Freedom. The F/A-18 Hornet provided the baseline design for the Boeing F/A-18E/F Super Hornet—a larger, evolutionary redesign of the F/A-18. The F/A-18 Hornet family of aircraft including the Hornet, Super Hornet, and EA-18G Growler has flown over nine million flight hours and continues to prove its value and reliability to the fleet and will continue to serve the nation for years to come.

- **Super Hornet:** The F/A-18 E/F Super Hornet is a combat-proven platform with demonstrated capabilities in multiple warfighting roles. The Block II aircraft provides enhanced capabilities over its predecessors.

- **EA-18G Growler:** The Navy's EA-18G Growler is designed to be a mission-changing electronic attack aircraft that combines the demonstrated capability of the Super Hornet's suppression of enemy air defenses with superior jamming abilities in the reactive, pre-emptive, standoff, and escort roles. The EA-18G Growler is a variant of the combat-proven F/A-18F Super Hornet Block II, and will fly the airborne electronic attack mission. The EA-18G combines the capability of the combat-proven Super Hornet with the latest avionics suite evolved from the Improved Capability III system. The EA-18G's vast array of sensors and weapons provides the warfighter with a lethal and survivable weapon system to counter current and emerging threats.
- **F/A-18 Hornets, Super Hornets and EA-18G Growlers** currently operate in 43 U.S. Navy and 11 U.S. Marine Corps Strike Fighter and Electronic Attack Squadrons from carriers and air stations worldwide. There are an additional 14 squadrons carrying out training, test, reserve and flight demonstration duties.

Contractor	<ul style="list-style-type: none">• Boeing (McDonnell Douglas Aerospace)• Northrop Grumman (Airframe)• General Electric (Engines)• Raytheon (Radar)		
F/A-18C/D Hornet		F/A-18E/F Super Hornet	
Power Plant	<ul style="list-style-type: none">• Two F404-GE-402 afterburning engines, each in the 18,000 pound thrust class, which results in a combat thrust-to-weight ratio greater than 1-to-1. Depending on the mission and loading, combat radius is greater than 500 nautical miles.	<ul style="list-style-type: none">• Twin F414-GE-400 engines, each in the 22,000 pound thrust class. On an interdiction mission, the E/F will fly up to 40 percent further than the C/D.	
Accommodations	<ul style="list-style-type: none">• The F/A-18C and F/A-18E are single seat aircraft.• The D and F models are flown by two crew members.• The aft seat in the D and F may be configured with a stick and throttle for the training environment (or without when crewed with a Weapons System Officer).		
Performance	<ul style="list-style-type: none">• F/A-18C maximum speed at level flight in altitudes of 36,089 feet: Mach 1.7	<ul style="list-style-type: none">• F/A-18E maximum speed at level flight in altitudes of 36,089 feet: Mach 1.6	
Armament	<ul style="list-style-type: none">• F/A-18C/D can carry up to 13,700 pounds of external ordnance.• Weapon stations include two wingtip stations for Sidewinders; two outboard wing stations for air-to-air or air-to-ground weapons; two inboard wing stations for fuel tanks, air-to-air, or air-to-ground weapons; two nacelle fuselage stations for the AIM-120 advanced medium-range air-to-air missile, AIM-7 Sparrow, or sensor pods; and one centerline station for fuel or air-to-ground weapons.	<ul style="list-style-type: none">• F/A-18E/F can carry up to 17,750 pounds of external ordnance.• Two additional wing store stations have been added.	
Mission & Capabilities	<ul style="list-style-type: none">• The F/A-18C/D Hornet can perform both air-to-air and air-to-ground missions.• Cockpit displays and mission avionics are thoroughly integrated to enhance crew situational awareness and mission capability in high threat, and adverse weather/night environments.• Cockpits are night vision goggle compatible.• Multi-Sensor Integration and advanced data link capabilities further enhance situational awareness.	<ul style="list-style-type: none">• The F/A-18E/F Super Hornet is able to perform a strike tanker mission while carrying a self-protection air-to-air missile loadout.• The E/F model also has greater payload flexibility, increased mission radius, survivability, payload bring back, and a substantial avionics growth potential.	

A Fleet introduction strategy of retrofit by attrition will be implemented with chevrons being a preferred spare.

1. Reduction in near field SPLs by a minimum of 2.5 dBA with a goal of 3 dBA in the audible spectrum.
2. Without impact to thrust in all flight regimes.
3. Cost of manufacture of the new configuration (VEN seals with chevrons) will not substantially exceed the current program of record cost for the existing VEN seals.

PMA265 has conducted a series of tests over the course of seven years to determine the suitability of chevrons:

2009

F404 engine test at NAWCAD Lakehurst produced the results shown in the figure above. This test used ceramic/metallic prototype test article

VEN seals which were structurally rigid, allowing moderate impingement into the exhaust plume.

2012

Follow-on static test of the chevrons installed on an F/A18E aircraft/F414 engine tied down at the catapult

facility at NAWCAD Patuxent River, Maryland. Because of adverse weather conditions, the results from this test were inconclusive. Moreover, the prototype VEN seals developed for this test were fabricated using ceramic matrix composites. This material



TOP: Dr. Steven Martens, GE Aircraft Engines (left), Dr. John Spyropoulos and Alan Pentz, NAVAIR Propulsion and Power, were part of the December 2012 engine test team at NAWCAD Patuxent River, MD.

RIGHT: Mike Rudy, former ESOH Coordinator for the F/A-18 Program Office (now with Wyle Laboratories, Inc.), stands in front of a Super Hornet during the December 2012 test of the experimental exhaust nozzle chevrons conducted at NAWCAD Patuxent River, MD.



AWARDS THROUGH THE YEARS

The F/A-18 Program Office has been recognized for consistent dedication to the Department of the Navy's ESOH goals and honored with the following awards:

- Chief of Naval Operations Environmental Excellence in Weapon System Acquisition, Large Program awards in 2001, 2003, 2005, 2007, 2009, 2011, and 2013. These awards are awarded for large acquisition programs every two years; hence this represents outstanding, consecutive achievement.
- Secretary of the Navy (SECNAV) Environmental Excellence in Weapon System Acquisition, Large Program, and Team Award in 2003, 2011, and 2013. The SECNAV award is the highest award for environmental excellence made by the Department of the Navy.



(termed Ox-Ox by GE Aircraft Engines) is the same as that used in the manufacture of original and replacement F414 VEN seals. Characteristics include resistance to high temperatures, thermal shock conditions, heavy vibration loads, flexibility and resistance to cracking.

2014

The most recent test was conducted at NAWCAD Lakehurst in October 2014. Again, this was a static test of chevrons F/A-18E installed aircraft engine tied down and the VEN seals with chevrons used were the Ox-Ox manufactured prototype. Preliminary tests results indicate no jet noise reduction during afterburner opera-

tions—marginal improvement at military power. The data collected are still under analysis. However, there appears to be evidence that the flexible characteristics of the Ox-Ox material is allowing the VEN seals to bend away from the exhaust plume negating more rapid mixing in the shear layer between the jet plume and the ambient air and jet noise reduction.

Medium term noise reduction (5 dBA reduction near-field) may build upon this chevron technology but will require more extensive modification/redesign of the existing F414 exhaust system and selection of a less flexible material for use in modified VEN

seals. The F/A-18 Program Office will continue to work with its industry partner (GE Aviation) to determine the technical and financial feasibility of this technology. Long term reductions (10 dBA near-field) may be considered by the Naval Aviation Enterprise as an ultimate goal for future naval aircraft.

FLEET INTRODUCTION

To date, the F/A-18 and EA-18G Program Office has expended over \$5.6 million on its jet noise reduction program. PMA265's original plan was for a replacement of all current VEN seals with the new chevron configured seals. This is termed a "forced retrofit" in the Navy logistics world



and would cost in excess of \$100 million. However, current budgetary constraints preclude such an aggressive approach. Moreover, VEN seals are expendable—they wear out after 400 to 500 hours of engine time and have to be replaced. Therefore a Fleet introduction strategy of retrofit by attrition will be implemented with

chevrons being a preferred spare. When an existing standard configuration seal requires replacement, the chevron configured VEN seal would be installed. This may provide approximately a 50 percent reduction in current engine exhaust noise levels of the F/A-18E/F F414 engine without additive cost as the chevron seals can

be produced for the same manufacturing cost as the original seals.

There are details to be worked out however. Are there any performance/structural issues caused by an asymmetric configuration (i.e., alternating standard configurations seals with chevron configured seals or chevrons on one engine and none

FOR MORE INFORMATION

- **F/A-18 Hornet/Super Hornet web site**
www.navair.navy.mil/index.cfm?fuseaction=home.display&key=3ABFFE4F-7D6E-40D0-A0E3-AED4FCB1C408
- **EA-18G Growler web site**
www.navair.navy.mil/index.cfm?fuseaction=home.display&key=33BFA969-0482-42CF-9E1F-F80A1B32BEE9
- **NAVAIR Facebook page**
www.facebook.com/NAVAIR
- **NAVAIR Twitter page**
www.twitter.com/navairnews
- **NAVAIR YouTube Site**
www.youtube.com/user/NAVAIRSYSCOM





F/A-18C Hornets launch simultaneously from the flight deck aboard the Nimitz-class aircraft carrier USS Harry S. Truman (CVN 75).

Photographer's Mate Airman Ryan O'Connor

on the other)? More testing will be required to provide answers to this question. Will the Fleet, wing and squadron commanders accept a non-uniform nozzle appearance on their aircraft? Preliminary discussions with CNAF staff have indicated their willingness to make this happen. Safety of their personnel is paramount to all commanders.

The user community (the Fleet, CNAF), Commander Naval Air Systems Command, and PEO(T) all strongly support this initiative and the F/A-18E/F and EA-18G Program Office is committed to its introduction into the Fleet. Should the results of the final installed static test meet the pass/fail criteria outlined above, this may offer a viable solution and a mandatory risk reduction effort in view of the documented incidence of jet noise induced hearing loss incurred by Navy and Marine Corp

personnel. This technology may reduce sound pressure levels to half of the current value, and will demonstrate the Navy's commitment in addressing one significant source of hearing loss. The impact of this technology is reduction in numbers of Naval personnel diagnosed with long term hearing loss, improvement of working conditions in high noise environments (e.g., U.S. Navy aircraft carriers) and decreased Department of the Navy liability to inverse condemnation litigation caused by jet noise. No other current research and development program addresses jet noise at its source—the engine nozzle and exhaust plume.

CONCLUSION

Although the research, development and delivery of this technology to the user, the Fleet, is incomplete, the narrative of the F/A-18 Program Office is

useful as an example of what a proactive, dedicated acquisition program can accomplish. ESOH goals may often take a back seat to higher priority military performance objectives. In this instance, a serious safety and occupational health problem (noise-induced hearing loss) was identified; a commitment was made to investigate solutions; an achievable design that showed promise was identified; and resources were committed to demonstrate and validate the proposed solution. This has required program leadership, dedication by a government/acquisition/industry team and hard work by systems engineering personnel to make it happen. ⚓

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Energy Conservation & Command Involvement Abound at Naval Hospital Bremerton

Energy Action Month Validates Ongoing Practices

THE MONTH OF October might be designated by the Navy as 'Energy Action Month,' but for Naval Hospital Bremerton (NHB) staff members, it's also a validation of the continuation of practices already in place that many active duty, civilian, contractor and American Red Cross volunteers make part of their daily routine at work and home.

"October as Energy Action Month challenges all of us to work together and my thanks to everyone for the conservation efforts thus far. Keep up the great work and look for new ways to conserve. Energy and water conservation are critical to our mission success. This year's theme (Energy Action Equals Mission Success) speak to how critical energy is critical to the Navy mission. Energy is our greatest enabler and our greatest vulnerability. Every kilowatt hour we save makes us more resilient and increases our ability to support the warfighter," said Capt. Christopher Quarles, NHB Commanding Officer.

NHB has also established a Command Energy Policy that engages all personnel daily to enhance energy effi-

ciency consciousness. The policy encourages every staff member to take the necessary steps to save energy such as keeping windows and doors closed, turning lights off when not in use, and prohibiting the non-essential use of personal refrigerators and heaters.

All during the month, staff members and their efforts were profiled through

'daily man-on-the-street' interviews about what they are doing to reduce energy usage at home and in the workplace. Their responses and photos, posted on the Command's Facebook page (at www.facebook.com/pages/Naval-Hospital-Bremerton/163929576969000) have drawn positive reviews and offer up a host of common sense approaches.



Every kilowatt hour we save makes us more resilient and increases our ability to support the warfighter.

—Capt. Christopher Quarles

“I shut off the lights, use the motion sensors lights at work, open up the blinds at home to bring in natural light, and during the colder season I use sweaters instead of using the heat to stay warm,” shared Kim Arias of NHB’s Laboratory department.

“I always make sure to turn off the lights and computers. We are always trying to reduce the amount of trash that we generate and recycle what we can to help conserve energy,” commented Hospital Corpsman Christian Wallace of NHB’s Endoscopy department.

Logistics Specialist 1st Class Samuel Kenyenso of Material Management

says that “conserving energy is critical and we all have to do our part. What we do on a daily basis is ensure that all lights are off before closing down for the day, turn off all equipment that is not in use, and keep track of the equipment that is left on for operational use.”

“We recycle a lot of paper,” said Hospital Corpsman 3rd Class (Fleet Marine Force) Angel Castilleja, Angel of TRICARE Operations. “I work in the healthcare business so we deal with a lot of paperwork. Everybody utilizes those shred bins to recycle paperwork. I think that’s a big help. At my last hospital, we didn’t have those shred bins.”

Family Practice’s Hospital Corpsman Chief Mark Sizemore also practices at home what he preaches at work with a little financial incentive added into the mix. “In order to teach my daughter responsible energy use, I charge her 25 cents every time she leaves the light on at home,” Sizemore said. “When we began back this exercise (back in January 2014), I would collect two to three dollars per month from my daughter. But over the last several months, I have collected less than a dollar a month. My now-11 year old daughter is getting more energy conscious—turning the lights off when she leaves a room. I put the money I’ve collected from her into our

The Basics About Naval Hospital Bremerton

NHB IS A community-based acute care and obstetrical hospital, offering expert primary care, emergency care and a broad range of medical and surgical specialties, with 23 inpatient beds. The hospital is conveniently located between Naval Base Kitsap (NBK) Bremerton and Puget Sound Naval Shipyard and NBK Bangor. NHB is parent command for three Naval Branch Health Clinics and the Puget Sound Family Medicine Residency Program. The three clinics are located at Puget Sound Naval Shipyard, NBK Bangor and Naval Station Everett.

NHB has a three-fold primary mission to support warfighters, past and present, and their families:

- Providing exceptional care anytime, anywhere.
- Shaping military medicine through training, research, and graduate medical education.
- Preparing forces for deployment.

NHB and its clinic’s staff consist of approximately 1,400 dedicated military, civilian, contract and American Red Cross volunteer personnel.

For more information about NHB, visit www.med.navy.mil/sites/nhbrem.





Hospital Corpsman Christian Wallace of NHB's Endoscopy Department recycles trash in a continuous effort to conserve energy on October 2, 2014. "I always make sure to turn off the lights and computers. We are always trying to reduce the amount of trash that we generate and recycle what we can to help conserve energy," said Wallace.

MC1 James Coyle

household utility bill. If she doesn't leave the lights on, she keeps her entire allowance and can save for whatever she wants to buy.

Ramon Calantas of NHB's Environmental Division attests that Energy Action Month helps to highlight energy successes at NHB such as the reduction of energy consumption and water usage.

"With the installation of four new condensing boilers in our heating plant, we have reduced our natural gas consumption this year by six percent, resulting in over \$15,000 in annual energy cost savings. We have installed advanced light emitting diode (LED) lighting fixtures on the outside of our buildings and are conducting pilot LED lighting studies in our parking lots and elevator lobbies, which save over \$3,000 annually in electricity costs. We have lighting controls in our restrooms and that turn lights out when the facilities are unoccupied, which save over \$1300 in electricity costs annually," stated Calantas. The Command is also planning to completely remodel the heating and ventilation systems and install more water efficient fixtures in our restrooms.

According to Robert E. Mitchell, NHB's Environmental Sustainability Program Manager and Command Energy Manager, some of the command's energy conservation projects fall under the radar, but still achieve the goals of sound environmental stewardship and practical energy savings, as well as cost savings. Some examples that Mitchell cited include a pending lighting controller project for Building 17 which will have day-lighting controllers and occupancy sensors installed in NHB's corridors and waiting areas. The command is



FROM LEFT: Logistic Specialist 2nd Class Richmond Voss, is assisted by Logistic Specialist Seaman Emily Jaske and Logistic Specialist 3rd Class Jessica Arredondo of NHB's Central Supply and Replenishment department as they sort through supplies on October 2, 2014. "The hospital's motion detection lights automatically turn off room lights—a good energy conservation method. We also continue to monitor all the stock at NHB to eliminate any unnecessary purchases which leads to greater efficiency and ultimately better energy conservation," said Voss.

MC1 James Coyle



Hospital Corpsman 2nd Class Danny Browning of NHB's Family Practice department sitting at his workstation. "I conserve energy by sitting in the dark and use desk lights at work instead of the overhead lights," explained Browning.

MC2 Zulema Sotelo



Kim Arias of NHB's Laboratory preparing to take blood from a patient. "I shut off the lights, use the motion sensor lights at work, open up the blinds at home to bring in natural light, and during the colder season I use sweaters instead of using the heat to stay warm," said Arias.

MC1 Gretchen Albrecht



Logistic Specialist 1st Class Samuel Kenyenso of NHB's Material Management department studies some paperwork at his workstation. "Conserving energy is critical and we all have to do our part. What we do on a daily basis is ensure that all lights are off before closing down for the day, turn off all equipment that is not in use, and keep track of the equipment that is left on for operational use," he said.

MC2 Zulema Sotelo

also installing room darkening roller shades in patient rooms and waiting areas on several upper level floors.

"Although no energy cost savings have been calculated, these rooms face east and west and are subject to bright sunlight. The shades will help block the sun's radiant heat into the rooms and should reduce the cooling load," stated Paula McAvoy, NHB Facilities Management project manager. Similar roller shades are also being installed in south facing windows at Branch Health Clinic Puget Sound Naval Shipyard.

With regards to cost savings, NHB Resource Conservation Manager John Payne noted that along with occupancy sensor installations in offices and exam rooms, the Command's heating, ventilation, and air conditioning system replacements and upgrades for NHB's main facility and adjacent Family Practice wing will have an estimated savings of 12 percent of yearly electrical use and 16 percent of natural gas use for a total of \$155,157 cost savings.

"We need everyone's participation to reduce our consumption of energy and become a part of the solution. We can achieve success, reach our energy goals, and ensure energy security when we change individual behavior and make NHB a more effi-

cient workplace that provides increased comfort for our workers and patients. Everyone can help conserve energy and water to meet our energy and water reduction goals and contribute to the Navy's mission," Quarles said. ⚓

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2015-16 *Currents* Calendar

Highlights Environment & Energy Savers

The Secretary of the Navy (SECNAV) Environmental and Energy & Water awards return to the *Currents* calendar stage for 2015-2016. Continuing with our 18-month format, we present the winners of each of the SECNAV awards and keep you covered through June 2016. Each month also includes an interesting tidbit related to an award winner.

Here are a few of the items you can expect to see:

May 2015: A rare sea turtle nests in a rare location at Oceana Dam Neck Annex and Mrs. Michael Wright knows what to do to protect the nest.

October 2015: Marine Corps Air Station Miramar employs the landfill to generate power and reduce greenhouse gas emissions.

March 2016: Naval Air Station Cecil Field restoration team's fast-track cleanup gets 99 percent of the property into recreational, educational and commercial use.

April 2016: USS Peleliu (LHA 5) saves 37,231 barrels of fuel, which translates to more than eight million pounds of reduced carbon emission.

June 2016: The F/A-18 program office (PMA265) wraps up the calendar with significant noise reduction techniques.

As the Navy's official energy and environmental magazine, *Currents* has the privilege to share the many ways the Navy's energy and environmental personnel and Sailors work to find and implement the best techniques to achieve their goals. *Currents* provides a forum in which all of you can share your knowledge and successes with your colleagues.

If you subscribe to *Currents*, you should be receiving your 2015-16 calendar very shortly. If you don't receive your calendar in the new few weeks, contact Lorraine Wass, our distribution manager, at ljwass@outlook.com or 207-384-5249 to request a copy. And don't forget to check us out online at <http://greenfleet.dodlive.mil/currents-magazine>.



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**Thanks for all of your great work
and we look forward to seeing more
from you in the pages of *Currents*!**

SERDP & ESTCP Announce 2014 Projects of the Year

Awards Showcase Program Successes

CONGRATULATIONS TO THE Strategic Environmental Research and Development Program (SERDP) and Environmental Security Technology Certification Program (ESTCP) Projects of the Year, recognized for research and technology developments with significant benefits to the Department of Defense (DoD). These outstanding efforts are helping DoD enhance its mission capabilities, improve its environmental and energy performance, and reduce costs. Details about their award-winning projects are available on the SERDP and ESTCP website at www.serdp-estcp.org/News-and-Events/News-Announcements/Program-News/SERDP-and-ESTCP-announce-2014-Projects-of-the-Year.

Recipients of this prestigious honor are as follows.

SERDP Projects of the Year

Environmental Restoration

Basic Research Addressing Contaminants in Low Permeability Zones (ER-1740)

Dr. Tom Sale, Colorado State University

Munitions Response

Decision Support Tools for Munitions Response Performance Prediction and Risk Assessment (MR-2226)

Dr. Laurens Beran, Black Tusk Geophysics

Resource Conservation & Climate Change

Shoreline Evolution and Coastal Resiliency at Two Military Installations: Investigating the Potential for and Impacts of Loss of Protecting Barriers (RC-1702)

Dr. Rob L. Evans, Woods Hole Oceanographic Institution

Weapons Systems & Platforms

Design-of-Experiment Approach to Hydrogen Re-Embrittlement Evaluation (WP-2152)

Mr. Scott M. Grendahl, U.S. Army Research Laboratory

ESTCP Projects of the Year

Energy and Water

Rapid Building Assessment (EW-201261)

Mr. Swapnil Shah, FirstFuel Software

Environmental Restoration

Use of On-Site Gas Chromatograph/Mass Spectrometer Analysis to Distinguish Between Vapor Intrusion and Indoor Sources of Volatile Organic Compounds (VOC) (ER-201119)

Use of Compound-Specific Stable Isotope Analysis to Distinguish Between Vapor Intrusion and Indoor Sources of VOCs (ER-201025)

Dr. Thomas McHugh, GSI Environmental Inc.

Munitions Response

Hand-Held Electromagnetic Induction Sensor for Cued Unexploded Ordnance (UXO) Discrimination (MR-200807)

Man-Portable Electromagnetic Induction Array for UXO Detection and Discrimination (MR-200909)

Dr. Dan Steinhurst, Nova Research, Inc.,

Dr. Tom Bell, Leidos

Mr. Glenn Harbaugh, Nova Research, Inc.

Weapons Systems & Platforms


Electrodeposition of Nanocrystalline Cobalt-Phosphorus Coatings as a Hard Chrome Alternative (WP-200936)

Mr. Ruben A. Prado and Mr. Jack Benfer, Fleet Readiness Center Southeast

Visit the SERDP and ESTCP blog at <https://serdp-estcp.org/News-and-Events/Blog> to read the blog entries about each of these award-winning projects.

SERDP is DoD's environmental science and technology program, planned and executed in partnership with the Department of Energy and the U.S. Environmental Protection Agency, with participation by numerous other Federal and non-Federal organizations. The Program focuses on cross-service requirements and pursues solutions to the Department's environmental challenges while enhancing and sustaining military readiness.

ESTCP is DoD's environmental technology demonstration and validation program. Projects conduct formal demonstrations at DoD facilities and sites in operational settings to document and validate improved performance and cost savings. Demonstration results are subject to rigorous technical reviews to ensure that the conclusions are accurate and well supported by data.

For more information, please visit www.serdp-estcp.org. 

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2014 Navy Community Service Environmental Stewardship Flagship Award Winners Announced

Navy Commands Engage in Exemplary Voluntary Community Service that Promotes Environmental Stewardship

THE NAVY ANNOUNCED the winners and honorable mentions in the 2014 Navy Community Service Environmental Stewardship Flagship Awards on November 18, 2014.

Deputy Chief of Naval Operations for Fleet Readiness and Logistics (N4) Vice Admiral Philip H. Cullom released a naval message listing the awardees. In the naval message, Cullom saluted the awardees.

“Your outstanding actions embody the Navy’s commitment to protecting the environment and enhancing our relations with our neighbors and local communities,” said Cullom. “Please accept my personal bravo zulu and thanks for your continued support of our Navy’s community service program.”

The 2014 winners by category are as follows:

Shore command category:

- Small (under 200 personnel): Navy Environmental and Preventative Medicine Unit 2, Norfolk, Virginia
- Large (500 or more personnel): Naval Base Coronado, California

Sea command category:

- Small: Fleet Ballistic Missile Operational Test Support Unit 2, Cape Canaveral, Florida
- Medium (200 to 499 personnel): Helicopter Sea Combat Squadron 23, San Diego, California
- Large: USS America (LHA 6)

Overseas command category:

- Large: Camp Lemonnier, Djibouti.

Commands receiving honorable mentions include:

- Small shore command: Naval Aviation Schools Command, Pensacola, Florida

USS America (LHA 6) won the 2014 Navy Community Service Environmental Stewardship Flagship Award in the sea command, large ship category.



- Large shore command: Naval Air Station Whidbey Island, Washington
- Small sea command: 21st Dental Company, Marine Corps Base Kaneohe Bay, Hawaii

Examples of winning initiatives include organizing educational community outreach events, recycling and participating in environmental conservation and enhancement projects, such as environmental clean-ups, shoreline restoration, tree and shrub plantings and invasive species removal.

Award winners will receive commemorative plaques, and honorable mentions will receive signed certificates from N4.

The Environmental Stewardship Flagship, which is sponsored by N4, is one of five flagships in the Navy Community Service program. The other four flagships are:

1. Personal Excellence Partnership
2. Project Good Neighbor
3. Campaign Drug Free
4. Health, Safety and Fitness

For additional information about the Navy’s energy, environment, and climate change initiatives, visit <http://greenfleet.dodlive.mil>. 

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Nominations Sought for CNO Environmental Awards

Submissions Were Due January 9, 2015

REAR ADMIRAL KEVIN SLATES, director of Navy's Energy and Environmental Readiness Division (OPNAV N45), issued a formal call for nominations to Echelon II commands on September 10, 2014 to solicit nominations for the fiscal year (FY) 2014 Chief of Naval Operations (CNO) Environmental Awards competition.

Each year the CNO honors Navy ships, installations, teams, and individuals for outstanding work in Navy environmental programs. Awards categories alternate annually based on a two-year cycle (between odd and even fiscal years). The achievement period for the FY 2014 competition is October 1, 2012 through September 30, 2014.

Award nominations must be sent via command channels/ Echelon II commands to OPNAV N45. The deadline to submit nominations is 11:59 p.m. Eastern Standard Time January 9, 2015.

Echelon II commands may submit nominations for each of the following 11 award categories:

1. Natural Resources, Large Installation
2. Environmental Quality, Industrial Installation
3. Environmental Quality, Overseas Installation
4. Sustainability, Non-industrial Installation
5. Sustainability, Individual/Team
6. Environmental Restoration, Installation
7. Cultural Resources Management, Small Installation
8. Cultural Resources Management, Individual/Team

9. Environmental Excellence in Weapon System Acquisition, Small Program, Individual/Team

10. Environmental Planning, Team

11. Afloat (includes five competitive sub-categories)


Environmental experts from the government and private sector will evaluate nominations and determine winners at the CNO level of competition. CNO winners will advance to the Secretary of the Navy (SECNAV) Environmental Awards competition. Likewise, with the exception of winners in the Environmental Afloat and Environmental Planning categories-which are unique to the CNO and



Previous CNO Environmental Award winner (Sustainability, Non-industrial Installation) Naval Base San Diego funded and executed photovoltaic projects to reduce energy use.

Adrianna delos Santos

SECNAV levels of competition-eligible SECNAV winners will advance to the Secretary of Defense Environmental Awards competition.

For more information about the CNO Environmental Awards program and a list of past winners, visit <http://greenfleet.dodlive.mil/environment/awards>. 

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NAVSUP Launches Chemical Compatibility Program

New Program Ensures Compatibility of Hazardous Material Product Storage

PERSONNEL FROM THE Naval Supply Systems Command (NAVSUP) are launching the Chemical Compatibility Program (CCP) to help Sailors safely store hazardous materials. The ships use numerous chemicals that can react with each other and cause fires if they are stored improperly.

Hazardous Material Control and Management (HMC&M) is one of the most critical and diverse Product and Service (P&S) lines provided to the Fleet by Global Logistic Services (GLS) and all the Fleet Logistic Centers (FLC) worldwide. Products containing hazardous materials are used every day throughout the Navy during the maintenance, preservation, cleaning and upkeep of Navy assets. As a result, Sailors must determine how to safely store hazardous materials.

With help from the Naval Sea Systems Command, Board of Inspection and Survey (INSURV), the Navy Safety Center, NAVSUP Headquarters, NAVSUP Weapon Systems Support, and the Type Commanders, NAVSUP GLS personnel developed the CCP to help those Sailors make the proper storage determinations.

It is each Sailor's responsibility to determine which materials may be stored together and which materials should be segregated to minimize the risk of an unfavorable reaction.

Due to the corrosive, reactive, and flammable "hazardous" nature of many products, special care is required by all hands. It is each Sailor's responsibility to determine which materials may be stored together and which materials should be segregated

to minimize the risk of an unfavorable reaction. This is a manual and time consuming process that, by its very nature, is subject to human error.

To reduce the potential for that error and minimize the risks associated with other storage issues, the CCP was developed and has been incorporated into the Hazardous Inventory Control System (HICSWIN) software (version 3.0). When a National Item Identification Number (NIIN) is entered into HICSWIN, it assigns a Hazardous Characteristic Code (HCC) to that item. The HCC is the key element to determine where an item should be stored so that it will be stored in a location that is compatible with other items stored in the same area. Using the assigned HCC, the HICSWIN software assigns a color to that NIIN. It is this color code that the user will use to ensure that the item is stored with compatible items.



Chemical Compatibility Matrix

Material	Acid	Alkali	Flammable	Corrosive	Reactive	Other
Acid	1	2	3	4	5	6
Alkali	2	1	3	4	5	6
Flammable	3	3	1	4	5	6
Corrosive	4	4	4	1	5	6
Reactive	5	5	5	5	1	6
Other	6	6	6	6	6	1

Key

- 1: Compatible - Store in same area
- 2: Incompatible - Store in separate area
- 3: Incompatible - Store in separate area (Flammable)
- 4: Incompatible - Store in separate area (Corrosive)
- 5: Incompatible - Store in separate area (Reactive)
- 6: Incompatible - Store in separate area (Other)

Notes:

- (1) Safety data for chemical storage
- (2) Follow the HCC group for storage location
- (3) For items not covered by the above matrix, consult the HICSWIN database for HCC
- (4) Specific instructions
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Products containing hazardous materials are used throughout the Navy during the maintenance, preservation, cleaning and upkeep of Navy assets. As a result, Sailors must determine how to safely store hazardous materials.

MC2 James R. Evans



The CCP assigns color codes to National Stock Numbers (NSN) by Hazardous Characteristic Code (HCC) groupings that have been determined compatible for storage. The program is user friendly even taking into account color blind personnel. (To accommodate color blind personnel, a description of the color (e.g., red, light blue) also appears along with the color assigned to a NIIN.) Storage locations are color coded during the implementation process and NSNs with the same color codes are placed within the corresponding locations.

HICSWIN 3.0 takes the CCP one step further by generating a chemical compatibility report to be run at the durations defined by the Hazardous Material Officer or supervisor. A warning is generated at the receipt or transfer of material if locations and materials are incompatible.

Every ship has a Consolidated Hazardous Material Reutilization and Inventory Management Program (CHRIMP) technician who will be spearheading this initiative and implementing these two critical systems

(HICSWIN 3.0 and the actual process to implement CCP) across all Navy ship classes in all homeports. The CCP was incorporated into the hazardous materials management procedures aboard all ships and upgraded to HICSWIN 3.0 from a previous version of HICSWIN.

Questions about the CCP or HICSWIN upgrades should be directed to the appropriate ship CHRIMP technician, the NAVSUP GLS hazardous materials lead or Jehdia Bottinelli at the information provided. [📍](#)

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Ground Source Heat Pumps Improve Energy Efficiency in the Northwest

Naval Base Kitsap Finds Success with Renewable Energy System

A NEW GROUND source heat pump system came on-line in the fall of 2014 at Naval Base Kitsap Bremerton, Bachelor Enlisted Quarters (Building 1001) using the Navy's Energy Conservation Investment Program funding to cover the costs of installation.

Ground source heat pump technology uses the relatively constant temperature of the Earth to provide building heating and cooling via a heat exchange system. The efficiency of ground source systems is considerably higher than that of traditional air source systems, and ground source heat pump systems are considered a renewable energy technology.

The first system installed under the same project came on-line in the fall of 2013 at Building 1044, and is operating effectively and efficiently through its first heating and cooling seasons. Ground source heat pumps provided approximately 80 percent of the building's heat requirement and base steam provided the remaining 20 percent when outside temperatures were the coldest. Such hybrid systems are often the best option for the Northwest's climate. The hybrid configuration allows the heat exchange piping to be sized to cover the load most of the time, rather than all of the time. It significantly reduces the installation cost while still providing most of the efficiency benefit. Building 1044's ground source heat pump system provides both heating and cooling for the facility.



Naval Base Kitsap Installation Energy Manager Paul Songe-Moller and Resource Efficiency Manager Brian Dimak check readings at the source, in the Building 1044 mechanical room, in preparation for the measurement and verification phase of the ground source heat pump system project.

Ground source heat pump systems require drilling wells or excavating the grounds surrounding the building to install heat exchange piping, which makes the first cost considerably higher than for other heating and cooling options. Buildings without sufficient land adjacent for the heat exchange piping are not candidates for the technology.

According to the Department of Energy, ground source heat pump systems use 25 to 50 percent less electricity than conventional heating or cooling systems, and compared to air source heat pumps, they are quieter,

Ground Source Heat Pump Cost & Savings

Initiative/Project	Cost	Annual Cost Savings	Annual Energy MBTU Savings	Annual Water KGAL Savings	Simple Payback (Years)
Install Ground Source Heat Pumps at Bachelor Quarters (Buildings 1001 and 1044)	\$3,577,015	\$301,345	22,853	1,635	11.9

MBTU = million British thermal units, KGAL = thousand gallons

last longer, need little maintenance, and do not depend on the temperature of the outside air.

Naval Base Kitsap has had previous success with this basic technology. Systems installed under the Fiscal Year 2010 Energy Savings Performance contract for six buildings at Naval Base Kitsap's Keyport site have shown reduced maintenance and improved comfort over the previous systems.

Additionally, a system that exchanges heat directly with the Hood Canal, a large and deep body of salt water adjacent to Naval Base Kitsap's Bangor site, has been in operation for ten years. Other attempts to install systems that exchange heat directly in salt water have not proven viable in the Northwest. The main reasons have been the greater expense of heat exchangers that can withstand the corrosive nature of salt water, and environmental concerns over potentially changing the temperature of specific areas in the waters of Puget Sound where systems were considered. Bremerton and Keyport sites are located on the Puget Sound rather than the Hood Canal. One unusual factor that made the Bangor salt water system economi-

cally viable was that it was not practical to extend natural gas to the location, and the facility was previously heated with expensive electric resistance heat.

Ground source heat pumps are classified as a renewable energy technology, which could help the Navy meet Executive Ordered renewable energy goals. Since most renewable energy technologies have relatively long paybacks, ground source heat pump systems may compete well if funding becomes available specifically for renewable energy projects.

When the facility is a good candidate for the technology, ground source heat pumps are one of the most economically viable renewable energy options for the Northwest. ⚓

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Tell Your Story in *Currents* • Due Date for Summer 2015 Issue Submissions is April 17, 2015

Do you have a good story to tell about your energy or environmental accomplishments and want to share it with others? *Currents*, the Navy's official energy and environmental magazine, has won first place in the Navy's Chief of Information Merit awards competition three times. So it's a great place to tell your story.

Your experiences take on new meaning when you share them with *Currents* readers and on Facebook.

If you have a story that you'd like us to consider for our summer 2015 issue, you need to submit your article and images by Friday, April 17, 2015. Any submissions received after this date will be considered for our fall 2015 issue.

You can get a copy of the *Currents* article template by sending an email to Bruce McCaffrey, our Managing Editor, at brucemccaffrey@sbcglobal.net. And if writing isn't one of your strengths, don't worry about it. Bruce and his team will handle all of the editing necessary to get your story into publishable form.

Bruce is also available at 773-376-6200 if you have any questions or would like to discuss your story ideas.

As a reminder, your Public Affairs Officer must approve your article before *Currents* can consider it for inclusion in the magazine.

Don't forget to "like" *Currents* on Facebook at www.facebook.com/navycurrents. *Currents'* Facebook page helps expand the reach of the magazine and spread the news about all the great work you're doing as the Navy's energy and environmental guardians.

Currents Deadlines

Summer 2015 Issue: Friday, April 17, 2015
Fall 2015 Issue: Friday, July 17, 2015
Winter 2016 Issue: Friday, October 16, 2015
Spring 2016 Issue: Friday, January 15, 2016

You can also refer to your *Currents* calendar for reminders about these deadlines.

Join SERDP and ESTCP for an Upcoming Webinar

Promoting the Transfer of Innovative, Cost Effective & Sustainable Solutions

THE STRATEGIC ENVIRONMENTAL Research and Development Program (SERDP) and the Environmental Security Technology Certification Program (ESTCP) have launched a webinar series to promote the transfer of innovative, cost effective and sustainable solutions developed by SERDP and ESTCP. The series targets the end users, including practitioners, the regulatory community and researchers. The primary objective of the series is to provide the end users with cutting-edge and practical information from sponsored research and technology demonstrations in an easily accessible format at no cost to the participant.

The webinars are held approximately every two weeks on Thursdays from 12:00 to 1:30 PM Eastern time. Each webinar features distinguished speakers from one of SERDP and ESTCP's five program areas:

1. Energy and Water
2. Environmental Restoration
3. Munitions Response
4. Resource Conservation and Climate Change
5. Weapons Systems and Platforms

The series is currently scheduled through May 2015. Initial webinar topics have included vapor intrusion assessments at contaminated sites, new tools for advancing the understanding of marine mammal behavioral ecology, waste to energy technologies, energy audits and the management of contaminated sediment sites. Following the completion of each live webinar, archives of the presentation and audio will be available online. Future planned webinar topics include dense non-aqueous phase liquid (DNAPL) source zone management, acoustic methods for underwater munitions, solar technologies, lead free electronics and many others.



Future planned webinar topics include acoustic methods for underwater munitions, solar technologies, lead free electronics and many others.

To view the complete schedule of upcoming webinars and access archived files of past webinars, visit www.serdp-estcp.org/Tools-and-Training/Webinar-Series.

SERDP is the Department of Defense's (DoD) environmental science and technology program, planned and executed in partnership with the Department of Energy and the U.S. Environmental Protection Agency, with participation by

WEBINAR SERIES SCHEDULE FEBRUARY–MAY 2015

Date	Webinars	Presenters
February 5, 2015	Acoustic Methods for Underwater Munitions	Dr. Joseph Bucaro (Naval Research Laboratory) Dr. Kevin Williams (APL University of Washington)
February 19, 2015	Solar Technologies	
March 5, 2015	Lead Free Electronics	Dr. Peter Borgesen (Binghamton University, The State University of New York) Dr. Stephan Meschter (BAE Systems)
March 19, 2015	Bioremediation Approaches at Chlorinated Solvent Sites	Ms. Carmen Lebrón (Private Consultant) Dr. John Wilson (Scissortail Environmental Solutions, LLC) Dr. Robert Hinchey (Integrated Science and Technology, Inc.)
March 26, 2015	Resource Conservation and Climate Change	
April 16, 2015	Blast Noise Measurements and Community Response	Mr. Jeffrey Allanach (Applied Physical Sciences Corp.) Dr. Edward Nykaza (U.S. Army Engineer Research and Development Center)
May 7, 2015	Munitions Mobility	
May 28, 2015	Managing Munition Constituents on Training Ranges	Dr. Paul Hatzinger (CB&I Federal Services) Dr. Thomas Jenkins (Thomas Jenkins Environmental Consulting)

numerous other Federal and non-Federal organizations. The program focuses on cross-service requirements and pursues solutions to the Department's environmental challenges while enhancing and sustaining military readiness.

ESTCP is DoD's environmental technology demonstration and validation program. Projects conduct formal demonstrations at DoD facilities and sites in operational settings to document and validate improved performance and cost savings. Demonstration results are subject to rigorous tech-

nical reviews to ensure that the conclusions are accurate and well supported by data.

For more information, visit www.serdp-estcp.org. 

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Navy Launches "Energy Warrior" Campaign

New App Showcases Sailors, Projects That Can Disrupt the Future of Energy

IN SEPTEMBER 2014, the Navy released a new digital publication (app) called "Energy Warrior" that highlights the efforts of Sailors and other naval personnel who are taking innovative steps to conserve energy, lead behavioral change, and get the maximum warfighting punch out of every gallon. The current app can be downloaded and installed for free for use on Mac and Android tablets.

Related videos are posted on an Energy Warrior playlist on the U.S. Navy YouTube channel. Short summary videos are being provided to Armed Forces Radio and Television Service (AFRTS) channels and can be viewed aboard ships via Direct-to-Sailor (DTS) beginning this month.

Videos in this version of the app include profiles of Fire Controlman Chief Petty Officer Christopher Roberts, who started a competition aboard USS Benfold (DDG 65) that is optimizing shipboard energy use; retired Marine Corps infantry officer Eric McElvenny, who helps retired military personnel transition to energy-related careers through the Troops to Engineers/Energy Systems Technology Evaluation (ESTEP) Program; and Matt Schreck, energy program manager for Fleet Readiness Center Southwest, who is seeking ways to reduce energy waste to better support the warfighter on the front lines.

The app also provides facts about worldwide energy use, U.S. oil production, and Navy's ongoing energy projects that are supportive of the Secretary of the Navy and Chief of Naval Operations energy goals.


"Energy isn't something most of us walk around thinking about every day—we just power up our equipment and get to work," said Rear Admiral Kevin Slates, director of the Chief of Naval Operations Energy and Environmental Readiness Division. "This app and related videos can help our Sailors and civilians understand how truly critical energy is, both to our daily jobs and to enable combat capability through greater distance, increased time on station, and the ability to carry more and new payloads."



This app and related videos can help our Sailors and civilians understand how truly critical energy is.

—Rear Admiral Kevin Slates

Plans are underway for additional video profile interviews for a future version of the app. Commands with innovative energy projects, people, and ideas are encouraged to contact the Navy's energy team at energywarrior@navy.mil.

For additional information, visit the Energy Warrior page at <http://greenfleet.dodlive.mil/energy/energywarrior>. 

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A

DISRUPT THE FUTURE

AMERICA'S
NAVY



JBPHH Joins the Team to Fight Coconut Rhinoceros Beetle

Invasive Insect Poses Real Threat to Hawaii's Palm Trees

ALMOST FROM THE moment the first coconut rhinoceros beetles (CRB) were found on a Joint Base Pearl Harbor-Hickam (JBPHH) golf course at the end of 2013, a team of local, state, and federal agencies has been working to remove the invasive insect, which feeds on palm trees. The Navy and Air Force play a major part in this work, particularly as the beetle's breeding grounds have been found predominantly on JBPHH.

Cooperation between the military and other government bodies is key to limiting the spread of the CRB as well designing innovative ways to eliminate it entirely. While it is difficult to say how successful this effort will be, there is no question that collaboration has helped so far to check yet another invasive species in Hawaii.

"The state of Hawaii and the Navy are approaching this challenge as a team," said Rear Admiral Rick Williams, Commander Navy Region Hawaii and Naval Surface Group Middle Pacific. "We realized the potential effects this pest can have on our installations and on Oahu. So we joined forces quickly and took action

immediately with state and other federal agencies. We are providing manpower, resources, expertise and public awareness to stop the spread of the CRB on Oahu."

The ecology of Hawaii is fragile and the introduction of invasive species, whether accidental or otherwise, has been a major problem throughout its history. Many native organisms, having evolved in isolation from the rest of the world, cannot compete with or survive invasive species. Therefore, the state of Hawaii has had

to be vigilant in preventing new animals and plants from settling in and around the Islands. Some examples of other invasive species that Hawaii has struggled to stop are the coqui tree frog, the little fire ant, and the Australian tree fern. In many instances the introduced organisms have been destructive to local populations of native organisms, hazards to people, and nuisances in other ways. Ironically, the mongoose, introduced more than a century ago to control rats, is suspected of eating the CRB,



The coconut rhinoceros beetle (*Oryctes rhinoceros*).
Hawaii Department of Agriculture

We realized the potential effects this pest can have on our installations and on Oahu. So we joined forces quickly and took action immediately with state and other federal agencies.

—Rear Admiral Rick Williams

as remains of beetle shells have been found near nests with mongoose-size tooth marks in them.

The beetle has been found in various locations on JBPHH, which is adjacent to Honolulu International Airport, and in several places off-base since the initial discovery, but so far the nests have only been found on federal property.

The CRB (*Oryctes rhinoceros*) also known as the Asiatic rhinoceros beetle, is a member of the scarab family and originally comes from Southeast Asia. The beetle has a hard black shell with a horn on its head. Males have larger horns. Adult beetles are nocturnal and can grow to more than two inches long. The CRB feeds on coconut palm trees as well as oil palms and other palm species. The CRB can often kill a palm tree when feeding on it, which makes it very destructive for Pacific island ecosystems.

Guam has experienced a particularly extensive infestation of the CRB that has killed off about half of that island's coconut palm trees. In the case of Hawaii, the loss of coconut palm trees could affect tourism, which is Hawaii's primary industry. The iconic tree is widely recognized as a symbol for the state. The coconut itself is not a significant resource for the local economy, but its destruction would affect small businesses that sell locally harvested coconuts.



The adult CRB will dig holes into the base of palm tree branches to eat. Too much of this damage can kill the tree.

Hawaii Department of Agriculture

Feeding damage in V-shaped pattern left on leaves by the CRB.



The coconut rhinoceros beetle was first discovered in a trap on JBPHH on December 23, 2013. In January 2014, CRB eggs, larvae, and adults were confirmed to be present in a large mulch pile on the Morale, Welfare and Recreation (MWR) Mamala Bay Golf Course on base. The first beetles were identified by a Cooperative Agricultural Pest Survey by the U.S. Department of Agriculture (USDA) Plant Protection and Quarantine (PPQ) program and University of Hawaii (UH). Shortly thereafter, incident responders met with military facility personnel from JBPHH and a unified command was formed by the Hawaii Department of Agriculture (HDOA) with PPQ to work on eradicating the beetle infestation. Navy Region Hawaii, which includes JBPHH, joined a coordinated effort to combat the CRB as part of a team, along with experts from USDA, Federal Fire Department Hawaii, and the Hawaii Department of Land and Natural Resources. The team from JBPHH includes military and civilian personnel from both the Navy and the Air Force.

This team has been working to prevent the spread of the CRB and eventually remove it from the island of Oahu completely. Rob Curtiss, HDOA acting Plant Pest Branch control manager, says the work is being shared by all agencies involved. “HDOA and USDA are operating in a unified command structure, with HDOA as the lead agency. The other agencies are serving a variety of functions (DLNR is acting as project liaison. UH is provide research support. OISC is providing survey support while JBPHH are playing many different roles.),” Curtiss explains. He continues, “This level of collaboration is unique, but not unprecedented. This is the first time that I am aware of that HDOA, JBPHH, and USDA have worked so closely to combat an invasive species problem, though there have been tabletop exercises preparing everyone for this exact thing. HDOA also has a multi-agency response to the little fire ant on Oahu and on Maui.”

Naval Facilities Engineering Command (NAVFAC), Hawaii experts have been assisting the rest of the team to remove the CRB by constructing traps to place in areas where the



Boring holes made by the CRB on the trunk of a coconut tree.



More than 1,300 panel traps have been placed around the island of Oahu to catch adult CRB.
Hawaii Department of Agriculture

We are optimistic that we can eradicate coconut rhinoceros beetles from Hawaii, but it will require all of our effort and expertise.

—Rob Curtiss

CRB has been observed. There are two main types of traps being used—panel traps and barrel traps. The panel traps, by far the more common type, were purchased and put together by USDA and the Animal and Plant Health Inspection Service (APHIS) and can be seen hanging from large tree limbs. Many of the barrel traps were constructed by Seabees from the Construction Battalion Maintenance Unit (CBMU) 303 Detachment at JBPHH. Barrel traps are larger than the panel traps and placed on military or state land to avoid theft.

Dr. Cory Campora, a natural resources specialist at NAVFAC Hawaii, has been a part of this team from the start.

“The panel traps are basically a design that USDA APHIS uses for agricultural pest surveys, with the addition of an aggregating pheromone and ultraviolet (UV) light,” Campora said.

The barrel traps were designed by CRB researchers on Guam.

“The barrel traps actually have decaying green waste in the bottom to help attract adult beetles, in addition to the UV light and the pheromone lure. The UV lights are solar powered and help to draw the beetles into the trap similar to how moths are drawn to lights at night,” said Campora.

Campora added, “NAVFAC is committed to continue assisting the CRB effort. We are working on procuring air curtain burners to miti-

gate solid green waste such as palm and other tree logs, palm fronds, branches and other green waste that has not yet been mulched or chipped. NAVFAC is also working on contracting additional labor to assist with trap monitoring and maintenance, and is working on methods to address all potential CRB breeding areas on JBPHH.”

Several ideas were first considered to mitigate the problem of the CRB infestation. Some insecticides were tested, including Talstar, cypermethrin, and bromomethane. However, when these were used on the CRB adults and larvae they were all found to be ineffective, so treatment of nests with the insecticides was halted.

Nests containing CRB larvae have been discovered in a variety of mulch piles composed of materials such as tree trimmings, grass cuttings, and wood chippings. An initial measure that was devised to limit the growth of the CRB population was to grind the mulch being used as nesting material in a tub grinder. While this would not be an efficient means of destroying the eggs, it would kill all larvae and a significant number of adults—essentially buying time for the team, as CRB can spend several months in these early life stages. Not all adults are killed in this process, as the disturbance of the nest causes some adult beetles to fly away from the mulch pile and return after grinding is complete. Once the mulch

Utilitiesman 2nd Class (SCW) Justin McNairn from Construction Battalion Maintenance Unit (CBMU) 303 Detachment at JBPHH builds a CRB barrel trap.
Denise Emsley





Mulch containing CRB larvae is ground twice in a tub grinder to kill later life stages of the beetle.
CAPT Mike Williams

is ground twice, it is covered with a tarp to guard against beetles reestablishing a nest. When new CRB nests are discovered on base, they are quickly ground twice and covered to await further treatment.

As a substitute for burning the ground mulch, NAVFAC Hawaii proposed the idea of using composting to exterminate all life stages of the CRB. Two 40-cubic-yard roll-off containers were simply configured as in-vessel composting reactors. This included using 4-inch perforated pipe attached to electrical fans which provide atmospheric air during the composting process. As the material is loaded into the container, it is sprayed with a nitrogen rich fertilizer to promote rapid thermophilic bacteria growth. The temperatures within the container reach as high as 170 degrees Fahrenheit (°F) within 70 to 80 hours. Laboratory research indicated that at a temperature of 140°F for one hour, a mortality rate of 100 percent was achieved for both larval and adult CRB. Live CRB larvae and adults were placed on top of the mulch in an active in-vessel reactor and all were found dead within two

hours. Composting of infested mulch is presently continuing and is being used as the treatment for green waste. Burning of larger green waste such palm tree fronds and trunks using an air-curtain burner is being pursued. Different methods of burning the mulch will be explored to supplement the current in-vessel composting program.

The Navy and Air Force continue to provide support to the CRB project in various ways.

Campora said, “The NAVFAC Environmental Services Pest Control Shop, Naval Environmental and Preventive Medicine Unit 6 (NEPMU-6), and MWR staff at Mamala Bay Golf Course are working closely with HDOA to assume the responsibility of checking and maintaining all CRB traps on JBPHH. The NAVFAC Hawaii Environmental Department provides technical expertise in various areas, including solid waste disposal (green waste management), air (burning permits),



Mulch is covered after it has been ground twice to prevent beetles from re-establishing a nest.
Hawaii Department of Agriculture



Mulch is covered after it has been ground twice to prevent beetles from re-establishing a nest.

Hawaii Department of Agriculture

and natural resources (invasive species response). NAVFAC Hawaii also works closely with landscaping contractors to ensure that necessary contract modifications are completed for changes in green waste handling and disposal practices and provides oversight to confirm that proper green waste procedures are being followed.”

On April 4, 2014, the USDA devoted \$2.4 million from the Agricultural Act of 2014 for the CRB program in Hawaii. The Hawaii Invasive Species Council received \$500,000 for Fiscal Year 2015 to support the program. Additionally,

the Navy has contributed \$190,000 for monitoring the CRB. In May 2014, the Navy approved a two million dollar supplement for the CRB program.

The organizations working together have apparently managed to prevent the beetle from nesting beyond the borders of federal property. The Navy and Air Force have been major players on the CRB team and their contribution has facilitated the state and federal agencies to perform their pest management work, in addition to the manpower and resources the military has provided.

The Navy, Air Force and the state of Hawaii have been working to raise public awareness of the CRB issue since it first arose. New nests are frequently discovered on military land, but the people of Hawaii are encouraged to check their own properties for potential nesting sites.

“We are still in the discovery phase, so it is too early to measure true success,” Curtiss said. “We have placed 1,358 traps, and surveyed 66,311 palm trees. We need to continue to survey and destroy breeding sites, and we need everyone’s help. A breeding site could be as simple as someone’s backyard compost pile with grass clippings and other decaying organic material.”

While the effort is ongoing to prevent the CRB from establishing a permanent presence in Hawaii, the outlook is positive. “We are optimistic that we can eradicate CRB from Hawaii, but it will require all of our effort and expertise,” said Curtiss.

New ideas to remove the infestation are being proposed and tested, while those in place have been effective in clearing nests of the later life stages of the beetle.

An invasive species is nothing new to the islands of Hawaii, but it is hopeful that the work of the CRB team will result in the complete eradication of the latest pest on the island. ⚓

For More Information

FOR MORE INFORMATION about the CRB, visit the State of Hawaii’s Plant Industry Division web site at <http://hdoa.hawaii.gov/pi/main/crb>. Weekly updates on activities to eradicate the CRB on Oahu are posted by the Hawaii Invasive Species Council can also be found on this site.



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DID YOU KNOW?

How did I save energy for the Navy?

I continually encourage junior personnel to take the initiative to conserve energy in the ship's planning process. This consists of asking the Officers of the Deck to monitor the ship's speed, route, and departure times in hopes of achieving a more economical fuel rate. Initiatives such as these have greatly reduced USS Peleliu's fuel consumption rate. In fact in 2013, we burned 24 percent less fuel than the class average for LHA/LHDs and used 11 percent less energy than other LHA/LHDs on the waterfront.

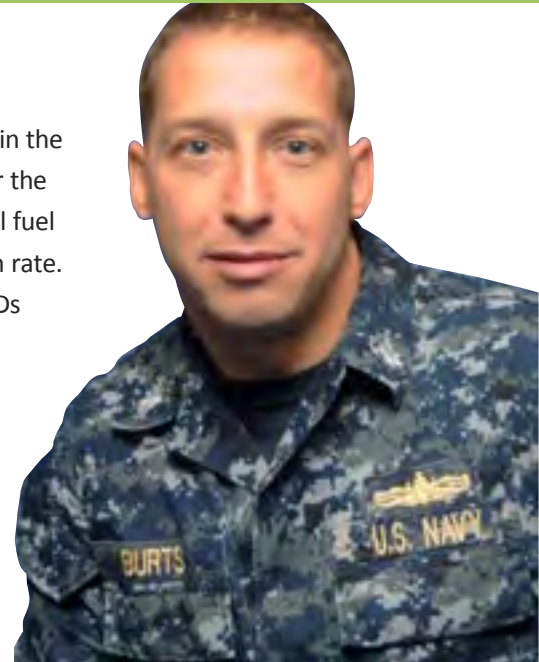
Name: Commander Jamie Burts

Age: 39

Hometown: Montrose, PA

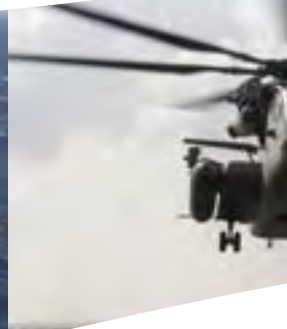
Job: Operations Officer

Command: USS Peleliu (LHA 5)



Do you think culture change, in regards to energy conservation, is important for our Navy?

A culture is merely a collection of habits, a way of doing things. It's important that energy conservation practices become habits—part of the planning and execution of our daily operations. This will allow us to introduce savings with minimal impact to our operations. By changing our habits and behaviors we can help decrease our energy expenditures and increase our cost savings which in turn will increase our operational effectiveness.



ENERGY SECURITY ENHANCES COMBAT CAPABILITY

Did you know that in 2013, USS Peleliu burned 24 percent less fuel than the class average for LHA/LHDs and used 11 percent less energy than other LHA/LHDs on the waterfront?

As we saw in Iraq and Afghanistan, a great amount of lives were lost during convoy operations related to refueling and providing energy to the warfighter. As the Operations Officer aboard USS Peleliu, my goal is to help change the behaviors and mindsets of the men and women on board—to encourage them to not only conserve energy during their daily operations but understand the role energy plays in supporting the warfighter and the Navy as a whole.

Most importantly, when it comes to energy conservation, we encourage everyone to work together as a team. Teamwork is crucial when it comes to conserving energy aboard USS Peleliu—there is no way any one of us could do it alone. Our engineers, for instance, play a crucial role in helping our ship reduce its energy consumption. We strongly encourage each and every one of

them to take the initiative to develop economical energy configurations, such as coming down on the amount of burner barrels, securing standby equipment, and identifying and correcting steam and water leaks. These initiatives not only help us meet the requirements of the mission but also help to reduce our overall energy consumption.

It's important that we start building the right energy conservation habits now and that we ingrain these habits into our planning considerations. Conserving energy will not only help us save money—which can then be used by our senior leaders to invest in other critical programs—but it will also allow us to spend valuable time and savings on more important combat capabilities, such as supporting the warfighter.

The USS Peleliu was the proud recipient of the 2013 Secretary of the Navy Energy Conservation Award—an award that recognizes Navy and Marine Corps activities for outstanding accomplishments in energy management.



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Spray Aeration Improves San Clemente Island Drinking Water

Inexpensive, Simple Technology Reduces Trihalomethane Concentrations

THE USE OF spray aeration technology has proven effective at reducing concentrations of trihalomethanes (THM) in the drinking water system at the U.S. Naval Auxiliary Landing Field, San Clemente Island (SCI), California.

SCI water program managers have been struggling since October 2005 to control high concentrations of THMs in the island's drinking water system, especially during the hot summer months when THM concentrations have been detected above the Safe Drinking Water Act, Maximum Contaminant Level (MCL) of 80 parts per billion (ppb).

For the small water system at SCI, treatment options are limited since everything (including drinking water) has to be barged to the island at high cost. (Costs for everything on the island is triple that of the California mainland.) A simple, but experimental technology, spray aeration, is now keeping THMs under control, below the THM MCL. This technology has an added bonus of improving disinfectant stability in the SCI water system through better water mixing.

San Clemente Island: A Remote Desert Island

SCI is the southernmost island of the Channel Islands off the coast of Southern California. This desert island is approximately 21 miles long and four miles wide (at its widest point) and has no local on-island sources of drinking water, so water must be

barged to the island. An offshore bombing range, the island is owned and operated entirely by the US Navy.

The drinking water system at SCI is a consecutive water system—a drinking water system that already receives treated water or “finished” water (potable water) that is ready for human consumption. The SCI barge



San Clemente Island.
Lencer

For the small water system at SCI, treatment options are limited since everything (including drinking water) has to be barged to the island at high cost.

is filled with potable finished water from either the City of San Diego or the Sweetwater Authority (SWA), the same water at all the San Diego area Navy bases. The source water has low concentrations of THMs. Unfortunately, THMs form after the potable water arrives at SCI.

Trihalomethanes Occur in Almost All Drinking Water Systems

To protect people from disease-causing organisms, or pathogens in drinking water, water suppliers often

add a disinfectant, such as chlorine, to drinking water. These disinfectants keep the water bacteriologically safe and potable. However, disinfectants can also react with low concentrations of naturally-occurring organic substances in the water to form byproducts such as THMs, which may pose health risks. At SCI, long water age (resident time in storage tanks or reservoirs) create more opportunity for THMs to form and have resulted in THM concentrations over 200 ppb.

U.S. Environmental Protection Agency (EPA) guidance on suitable and economically feasible Best Available Technologies (BAT) for drinking water treatment of THMs in consecutive systems is limited and doesn't include expensive treatment options available to primary water purveyors such as granular activated carbon (GAC). The EPA recognized that consecutive systems are not "primary" water suppliers or purveyors, should be receiving water ready for consumption, and should not be expected to

San Clemente Island Monthly and Annual Running Averages of Trihalomethane Concentrations



Although spray aeration is considered experimental at this point in time, it is slowly gaining acceptance from the regulatory community.

significantly treat the supplied water. (Note: “Finished” water is ready for human consumption and may only require disinfectant boosting in some cases.)

Techniques to control THMs in consecutive systems include management of hydraulic flow, including looping water distribution lines to eliminate dead-ends. Looping can be accomplished for some water systems to reduce water age within the distribution system, but may not be accomplished in others with long pipelines. Looping some water lines would cost millions of dollars.

Formation of THMs in SCI Drinking Water

THMS ARE PRESENT in the source water for the SCI barge (SWA and San Diego water) at levels far below the regulatory limit of 80 ppb. When the water reaches SCI, it is placed in the distribution system where it is re-chlorinated, stored, then distributed. The Navy maintains a free chlorine residual throughout the distribution system by recirculation as well as the injection of sodium hypochlorite solution at storage reservoirs on the island. With a long water residence time and a free chlorine residual, THMs continue to form as the chlorine reacts with low concentrations of preexisting precursors (natural organic matter (NOM)) present in the water. THM concentrations also increase with warmer temperatures. All drinking water has some concentration of NOMs. NOMs, measured as total organic carbon (TOC), averaged at a low concentration of two parts per million (ppm) for most of 2008 to 2011.

Because water must be barged to SCI, a reserve of water must be stored for contingencies such as fires or problems with barge deliveries. The water age at various points throughout SCI varies from about three days to approximately two months. Water this “old” must be re-chlorinated multiple times to maintain a minimum safe disinfection level. Most water from a tap should be no older than 3 days from the nearest water tank. THMs are not destroyed by the addition of chlorine, but THMs increase due to chlorination. Multiple chlorination events combined with a long residence time form high concentrations of THM.

Other solutions, such as flushing of water distribution piping is very effective for removing sediment and biofilms in the distribution piping which can contribute to THM formation, but improving the water quality feeding the distribution system from the water tanks is key to maintaining long term compliance with the THM MCLs for consecutive systems.

THM Treatment Alternatives Can Be Complex, Costly & Time Consuming

After receiving the first violation in August 2006 from the California Department of Public Health (CDPH), followed by an EPA Administrative Order (AO) against the Navy in 2007 for exceeding the THM MCL, the Navy wanted to use GAC—the best technology available to reduce THMs at SCI. Unfortunately, the estimated costs to install GAC at SCI were over three million dollars and no space was available at San Diego bases for a GAC treatment system. Producing drinking water from the ocean surrounding SCI using desalination technologies such as reverse osmosis were also cost prohibitive at approximately 21 million dollars. These technologies would also require five to six years (best case) to construct, and would involve complex and expensive environmental permitting for the brine ocean discharge and biological entrainment and entrapment issues with the ocean intake.

In December 2008, the EPA consecutive system BAT was implemented at SCI and the Navy switched from the predominately surface water source from the City of San Diego to the mixed water source (surface, groundwater, and desalinated water) from the SWA. Water storage at SCI was also reduced resulting in an average water age of approximately 20 days from an average of 34 days prior to reduction activities.

In 2009 and throughout 2010 and 2011, the drinking water system at SCI was back in compliance with the THM MCL. It appeared as though the consecutive system BAT was working. Early in this process, the Navy realized that the consecutive BAT may not be the long

term alternative to always maintain the THM concentrations below the MCL at SCI since source water quality can change based on drought conditions and other factors beyond the Navy's control. And future operational needs may increase water age.

In 2012, a THM "perfect storm" hit the SCI water system. The barge was scheduled for regular maintenance and, in anticipation, SCI took on additional water for the time that the barge was expected to be out of service. As a result, the average water age increased. At the same time, SWA provided source water which contained a higher blend of surface water with higher concentrations of NOM. By April 2012, THM concentrations soared and the SCI drinking water system was once again out of compliance with the THM MCL. High concentrations of

THMs occurred in the SCI water system until October 2013.

Spray Aeration: Simple & Workable with Existing Tank Recirculation Systems

Spray aeration entails spraying water into the headspace of a water tank to strip volatile THMs from the water. A positive pressure blower with an air filter is used to push fresh air into the tank headspace to remove the stripped THM gases out the tank air vents. At SCI, the existing tank water recirculation systems were modified for spray aeration by adding additional piping and spray nozzles. The design is based on non-clogging (large diameter particle pass-through) spray nozzles (a glorified showerhead) selected for producing the smallest water droplet size (based on water flow rate and pressure) and spray



Spray nozzle.
BETE

Best Available Technology (BAT) for THM/HAA5 Treatment

Primary Water Suppliers

EPA is proposing that the BAT for the THM and Haloacetic Acids (HAA5) Locational Running Annual Average (LRAA) MCLs (0.080 mg/L and 0.060 mg/L, respectively) be one of the three following technologies (for primary systems):

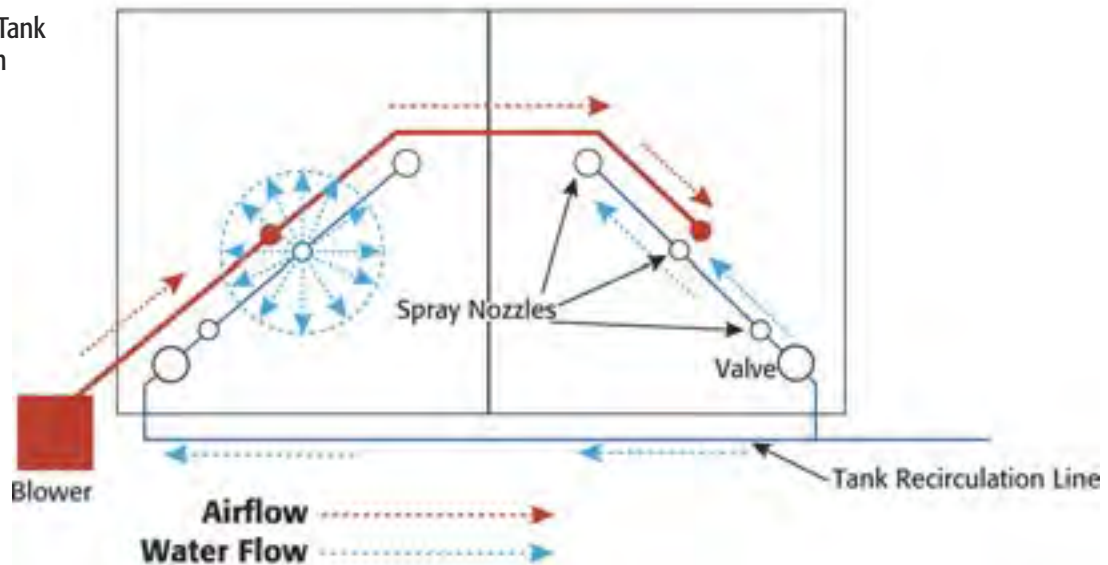
1. GAC adsorbers with at least 10 minutes of empty bed contact time and an annual average reactivation/replacement frequency no greater than 120 days, plus enhanced coagulation or enhanced softening.
2. GAC adsorbers with at least 20 minutes of empty bed contact time and an annual average reactivation/replacement frequency no greater than 240 days.
3. Nanofiltration using a membrane with a molecular weight of 1,000 Daltons or less (or demonstrated to reject at least 80 percent of the influent TOC concentration under typical operating conditions).

Small Consecutive Water Systems

EPA is proposing a different BAT for consecutive systems than for wholesale systems to meet the THM and HAA5 LRAA MCLs. The proposed consecutive system BAT is chloramination with management of hydraulic flow and storage to minimize residence time in the distribution system. This BAT stems from the recognition that treatment to remove already-formed disinfection byproducts (DBP) (like THMs) or minimize further formation is different from treatment to prevent or reduce their formation.

EPA believes that the BATs proposed for wholesale systems are not appropriate for consecutive systems because their efficacy in controlling DBPs is based on precursor removal and each of these BATs, when applied to water with DBPs, raises other concerns. GAC is not cost-effective for removing DBPs. Therefore, GAC and nanofiltration are not appropriate BATs for consecutive systems.

Rectangular Tank Aeration Plan (Plan View)



Rectangular tanks spray aeration configuration.

angle (based on tank configuration) to achieve the longest droplet travel distance. This differs from bubble aeration where air is bubbled into the bottom of the water tank and rising bubbles strip THMs from the water. Bubble aeration needs a large blower to overcome the water pressure in the tank.

Although spray aeration is considered experimental at this point in time, it is slowly gaining acceptance from the regulatory community. The CDPH is overseeing many spray aeration system pilot tests throughout California. A peer-reviewed article only first appeared in the journal of the American Water Works Association (AWWA) in 2011 (Brooke, E, Collins, MR. Post-treatment aeration to reduce THMs. Journal—American Water Works Association). The CDPH and EPA allowed the Navy to conduct its own spray aeration pilot scale test in October 2013.

Initial Spray Aeration Test at SCI

An initial spray aeration pilot test was conducted in October 2013 on a small 10,000-gallon tank at a remote location at SCI (also known as the “P-site”) with a long water age and a site subject to high concentrations of THMs. This initial pilot test was installed at minimal cost (less than \$5,000 in materials). Water system operators from the Naval Facilities Engineering Command installed a spray nozzle that was rated for 20 gallons per minute (gpm) on the existing water recirculation and booster chlorination system. A blower with piping and

electrical rated for an air flow 30 times of the water flow (30:1 air-to-water ratio) was installed to exchange air in the tank headspace. An existing water sampling port on the recirculation line was utilized for water quality monitoring and flows, chlorine concentrations and dosing,

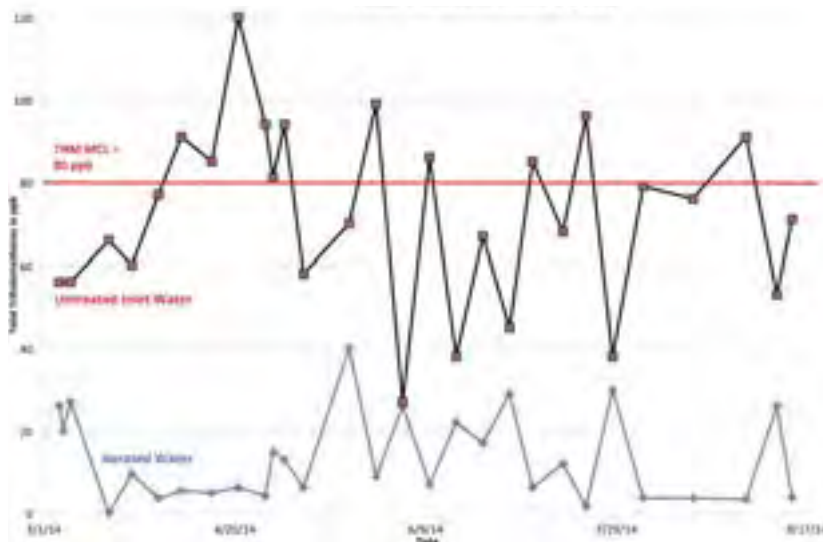
Barge Source Water

THE SOURCE WATER for the SCI barge varies in the level of THM precursors present. These precursors are NOM, sometimes measured as TOC, which reacts with chlorine to form THMs. Barge water had been supplied by the City of San Diego. The City's three treatment plants all treat local and imported surface water with no groundwater sources. The surface water sources have higher NOMs than groundwater or desalination plant sources. The SWA has multiple water sources/treatment plants:

1. The Robert A. Purdue Water Treatment Plant (which treats imported raw and local surface water)
2. The Richard A. Reynolds Groundwater Desalination Facility
3. The National City wells.

The groundwater sources have very low levels of precursors, while the surface water sources are higher. The predominant water blend of water from SWA received at Naval Base San Diego (the location of the SCI barge) is from SWA's groundwater wells and brackish water treated by reverse osmosis.

P-Site Tank Aeration Pilot Scale Test Results: Total Trihalomethanes (ppb)



P-Site Tank: Percent THM Removed



and THM concentrations were assessed as part of this initial test. Initial pilot test results were very promising. Over ten days, approximately 90 percent of the THM were removed from the tank water. Chlorine usage by the chlorine injection system did not increase, indicating that the chlorine in the water was not being stripped by the spray aeration system. In fact, it appeared that

chlorine concentrations in the tank were more stable, indicating better mixing and less chlorine demand in the tank water.

Expansion of Spray Aeration System at SCI

This initial success was reported to the CDPH and EPA in January 2014. Immediately after, the Navy



Aeration piping on a 40,000-gallon tank. Outside pipe is water heading up for spraying and inside pipe is the injected air pipe.

Thomas Niday

proposed upgrading the P-site aeration system and expanding the spray aeration system to all tank systems at SCI. The CDPH and EPA immediately accepted the proposed system upgrades and expansion. The upgrades and additional tank aeration systems were installed and operational throughout the first and second quarters of 2014. Total material and installation costs for the spray aeration system for the entire SCI water system were below \$75,000.

Spray Aeration Results: SCI Back in Compliance

Untreated inlet water to the P-site tank was over 80 micrograms per liter ($\mu\text{g/l}$) throughout the early part of 2014. Fortunately, during this time, spray aeration removed an average of 76 percent of the THMs. This resulted

San Clemente Island is now back in compliance with the trihalomethanes Maximum Contaminant Level.

in THM concentrations being maintained below 80 µg/l in the downstream compliance monitoring location. It is estimated that spray aeration removed from 56 percent to 86 percent of the THMs in the Rectangular Tank water (from the

dual set of SCI water tanks), averaging 67 percent removal efficiency overall. SCI is now back in compliance with the THM MCL.

One of the main concerns expressed about spray aeration was that the

chlorine disinfectant was going to be stripped from the water. To keep the water safe, chlorine must be maintained in the water. In reviewing chlorine dosing data from before and during aeration, it appears that chlorine is not stripped, and in fact, chlorine dosing rates are lower. Chlorine dosing rates are half that of non-aeration rates. It appears that spray aeration enhances the mixing of chlorine in the water tanks. Since chlorine in water doesn't exist as a gas but as aqueous hypochlorous acid (HClO), the chlorine will not be air-stripped from the water.

Overall THMs were reduced in the water reservoirs and at the compliance monitoring points at SCI due to a combination of:

1. Source water with low TOC concentrations from SWA.
2. Relatively low water age (currently 26.9 days).
3. Better water mixing in tanks (from both mixers and aeration).
4. Stripping of THMs using spray aeration.

Based upon these results, both the EPA and CDPH are inclined to close the EPA AO in the fall of 2014.

Recommendations for Navy Water Systems

EPA BATs for consecutive systems may work in some water systems with short average water ages, but as the SCI example shows, for water systems with long water ages, these BATs may only work in the short

**Rectangular Tanks Aeration Pilot Scale Test Results:
Total Trihalomethanes (ppb)**



Rectangular Tanks: Percent THM Removed





Water spray in a 40,000-gallon tank. Water is dropping eight feet.

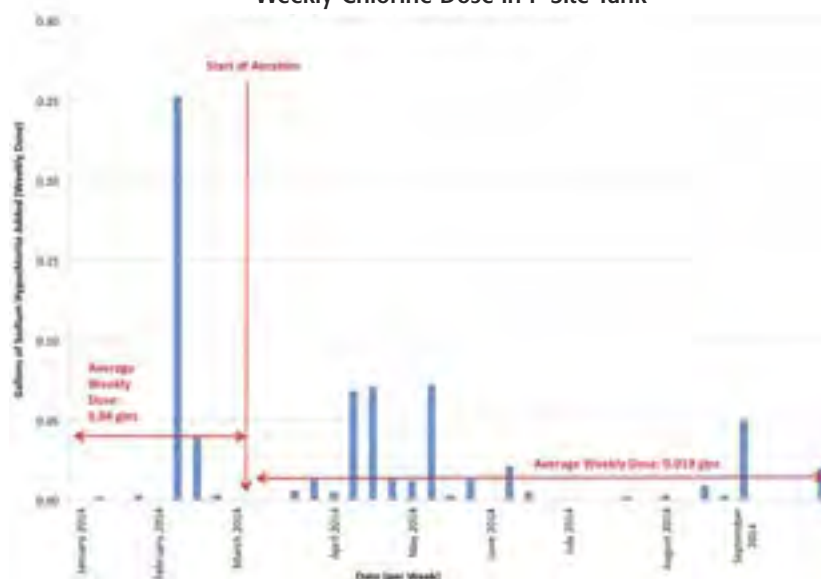
Thomas Niday

term. Hydraulic control measures such as looping water distribution lines can reduce water age and associated THMs within the distribution system, but may not be feasible in water systems with long pipelines due to high costs.

Weekly Chlorine Dose in Rectangular Tanks



Weekly Chlorine Dose in P-Site Tank



Unidirectional flushing of water distribution piping is very effective for reducing chlorine demand and THM formation within the distribution system, but improving the water quality feeding the distribution system from the water tanks is key to maintaining long term compliance with the THM MCL. A combination of internal tank mixers combined with spray aeration worked where the source water quality can change and water age is long. In some cases, a small tank with a spray aeration system and a chlorine booster may reduce THMs significantly for dead-end and/or remote areas at the end of long pipelines of a distribution system. Spray aeration also stabilizes chlorine levels in the tanks and distribution system, reducing the amount of chlorine dosed in the system. ⚓

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Naval Station Everett Uses Advanced Metering to Validate Energy Projects

Retro-Commissioning Projects Reduce Energy Use Up to 15 Percent

THE NAVAL STATION Everett energy team is using data from its advanced meters to validate energy projects at two buildings on the base.

Advanced utility meters, capable of showing how much energy is used in a building at specific times of the day and night, have been widely installed across government facilities. Such

“smart” meters are a relatively recent requirement of the Energy Independence and Security Act of 2007. Although the meters themselves do not save energy, they can lead to increased visibility of energy use. Energy managers use meter data to uncover excess energy consumption and to verify that measures undertaken to save energy have met their goal.

Most recently, the Naval Station Everett energy team used advanced meter data to help quantify and verify the cost savings from a retro-commissioning project at Naval Station Everett’s administration building (Building 2000). Retro-commissioning is a process of testing and correcting a building’s heating, air conditioning and fresh air distribution systems to ensure that individual components are working as designed, and that the system as a whole is working efficiently.

Retro-commissioning was completed on the south side of Building 2000 during August 2014, while the north side is scheduled to be completed at a later date. This allowed for comparison of meter data between the south and north side of the building as a control for interpreting the savings. The retro-commissioning process revealed that fan speeds should be reduced at many of the variable-air-volume air distribution terminals in rooms throughout the south side. This action saved energy and also improved occupant comfort. The process also revealed non-functioning dampers that have since been repaired. General testing



Naval Station Everett Resource Efficiency Manager John Payne with one of the installation’s new “smart” meters.

Doug LaPlante

With the help of building-level advanced meter data,
the energy team can show more definitively that a retro-commissioning
project in a particular building can reduce energy use.

and balancing of the air systems helped to even out temperatures throughout the facility. To date, electricity savings at Building 2000 is approximately 12 percent.

Another retro-commissioning project was conducted at the Naval Station Everett Child Development Center in the fall of 2013. The process revealed control problems that allowed heating and cooling systems to run at the same time, and identified faulty dampers. Dampers were repaired and temperature sensors relocated to restore efficient operations. An in-depth analysis of electrical and natural gas advanced meter data was adjusted for weather data and showed an energy reduction of 15 percent for that project through the first heating season.

The retro-commissioning efforts at Naval Station Everett have improved working conditions for a number of people:

- The projects benefit the building occupants who now work in a more comfortable and predictable climate throughout the day.
- Facility managers and maintenance personnel benefit because they can expect fewer temperature-related complaints from occupants.
- The energy team, the command, and taxpayers overall benefit because of reduced energy consumption.

With the help of building-level advanced meter data, the energy team can show more definitively that a retro-commissioning project in a particular building can reduce energy use.

Naval Station Everett Child Development Center (Building 1980).

John Payne

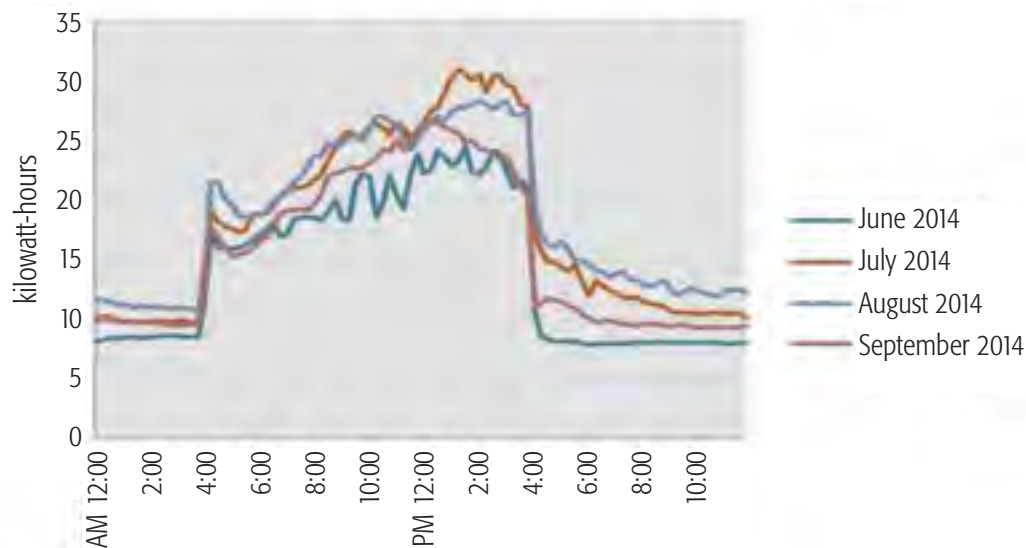


Naval Station Everett Administration Building (Building 2000).

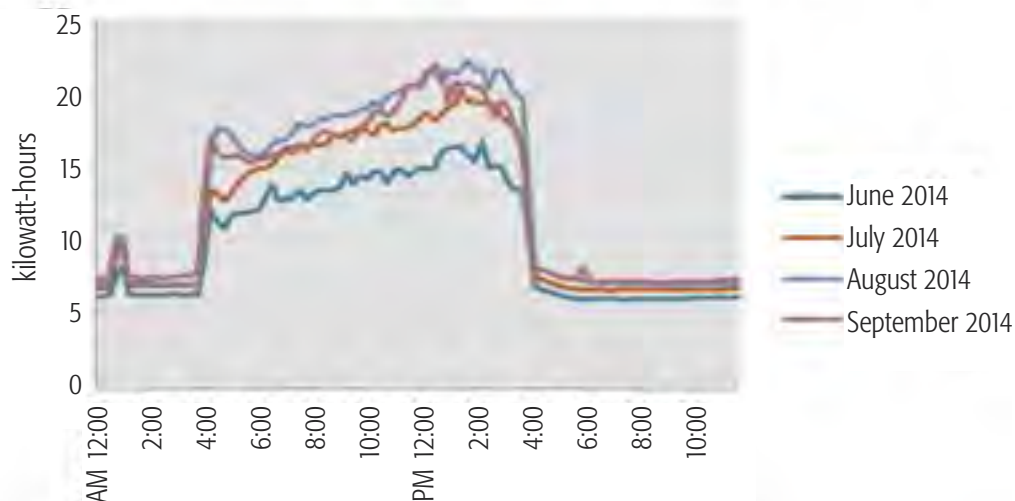
John Payne



B2000S Average Daily Electricity Consumption



B2000N Average Daily Electricity Consumption



The graphs above show the average electricity consumed at Building 2000 during different time intervals, June through September. The repair and tune-up phase of the retro-commissioning process began in late August and continued into early September. The north side of the building is somewhat smaller but very similar to the south side. The north side's graph

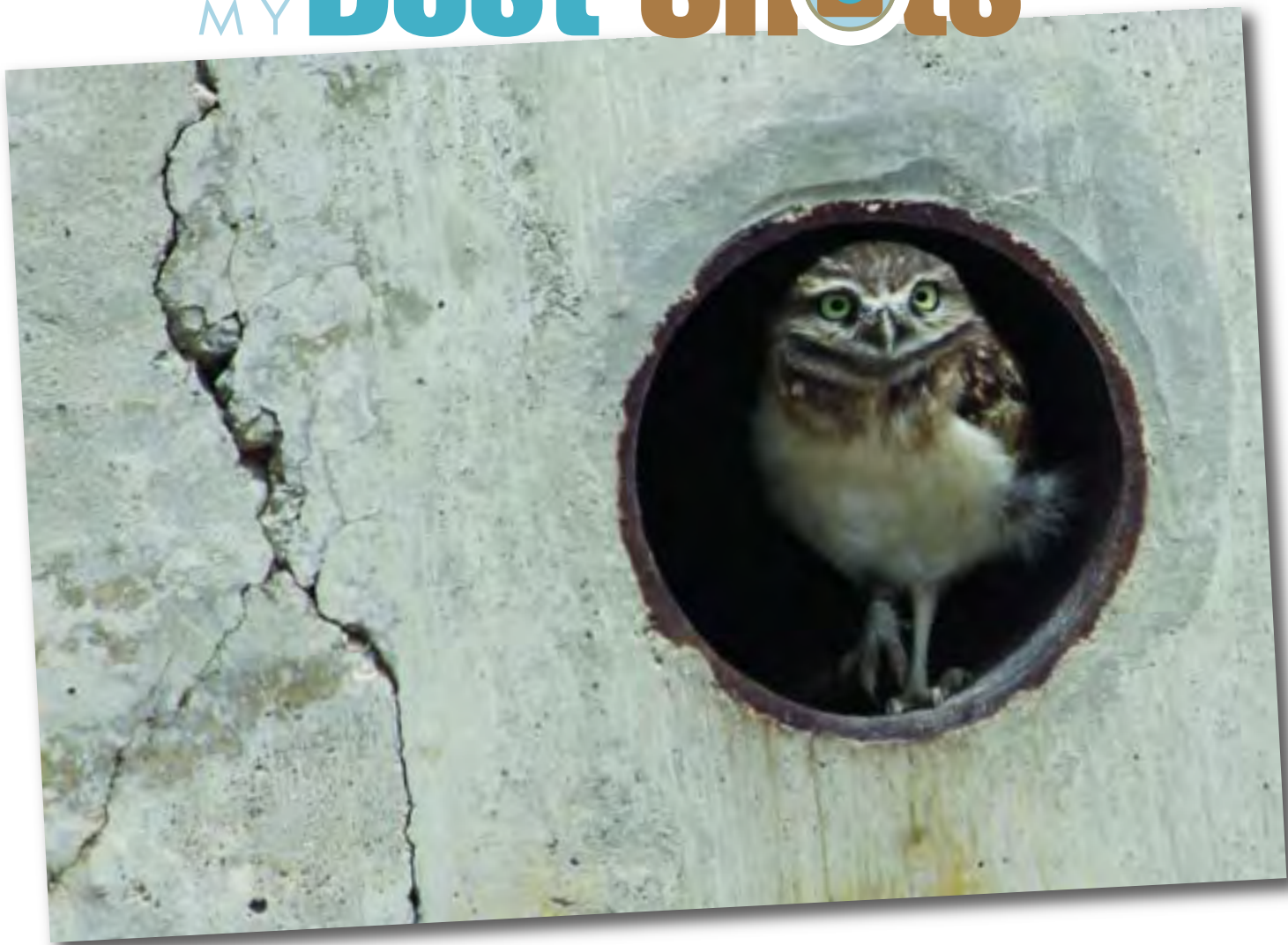
shows that energy use in June and July, prior to retro-commissioning, follows a pattern similar to the south side. August and September energy use relative to June and July energy use are lower on the south side than on the north side, showing that the energy reduction is not simply a result of lower outside temperatures. The savings are most noticeable during

afternoons in September when the south side energy use dips significantly relative to the north side energy use. [↗](#)

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ONE OF MY Best Shots



I captured this image of a juvenile burrowing owl (*Athene cunicularia*) at Naval Weapons Station (NWS) Seal Beach, California. It is resting in its “burrow”—in this case the drain pipe of a missile magazine. NWS Seal Beach is the only known coastal breeding location in Orange and Los Angeles counties. I used a Canon Rebel T2i, focal length 300 mm, ISO-100 at f/8.

Bob Schallmann ● Conservation Program Manager
Naval Weapons Station Seal Beach ● robert.schallmann@navy.mil

Submit your own Best Shot to Bruce McCaffrey ● *Currents'* Managing Editor ● brucemccaffrey@sbcglobal.net

ESTCP Explores Innovations to Maintain Shipboard Heat Exchangers

Initial Study Focuses on the Use of Iodine Bubbles to Reduce the Rate of Fouling

RESULTS OF A two year project led by personnel from the Naval Facilities Engineering and Expeditionary Warfare Center (NAVFAC EXWC) and funded by the Environmental Security Technology Certification Program (ESTCP) assess the potential of use of iodine-laced bubbles to reduce the rate of fouling within Department of Defense (DoD) shipboard heat exchangers.

Shipboard seawater-cooled heat exchangers are installed throughout ships to cool hydraulic, lubricating, and other system fluids, fresh water,

or air. Specific applications include providing cooling for engines, air conditioning systems, as well as low and high pressure air systems. Heat exchangers transfer heat generated by a ship's system using either metal tubes or plates to seawater that is discharged to the ocean. Bio-fouling occurs when both non-organic and organic contaminants collect on the surfaces of the tubes or plates in contact with the seawater and a layer forms which reduces water flow and reduces heat transfer.

Bio-fouling can significantly impact the functionality of DoD ships in a number of ways including fouling shipboard heat exchangers and ship hulls. Of particular concern are salt water environments. The existence of barnacles and other marine fouling species greatly increases the foul rate relative to other environments. Fouling of ship's surfaces can result in decreased heat transfer, increased drag, corrosion of ship's materials, increased fuel consumption, and the generation of greenhouse gases.

Seawater bio-fouling occurs by either or both microbial and macrobial fouling. Microbial fouling occurs when

microorganisms attract and stick to the heat exchanger tubes. These organisms can be anything from bacteria to slimes and algae. They attach to the heat exchanger wall and form bio-film slimes. Macrobial fouling occurs when larger macro organisms attach to the bio-film rather than directly on to the metal.

A Challenging Problem

Fouling of DoD shipboard heat exchangers is a chronic and costly operating problem that requires significant maintenance expenditures. Typically, fouling of heat exchange devices is addressed in one of three ways:

1. Take no action.
2. Use acid or mechanical cleaning methods.
3. Use electro-chlorination devices to minimize foul formation.

Each of these methods negatively impacts ship's operating costs, mission readiness, energy use, and the environment. Of particular environmental concern are acid cleaning and electro-chlorination.



Air conditioning plant condenser tube sheet from an air conditioning plant on board USS Anchorage (LPD 23).

Bio-fouling can significantly impact the functionality of DoD ships in a number of ways including fouling shipboard heat exchangers and ship hulls.

During an ESTCP research project (no. WP-201219) spearheaded by NAVFAC EXWC personnel, investigators found that the liquid waste from acid cleaning had a concentration of 2,000 parts per million (ppm) of copper, 800 ppm of nickel, and 100 ppm of zinc. This waste also had a pH of less than one. Depending on the size of the heat exchangers, these types of cleanings can result in the generation of thousands of gallons of hazardous liquid waste that is regulated by the

Resource Conservation and Recovery Act (RCRA). Disposal of this waste normally costs from \$2 to \$12 per gallon, thus the total cost for a heat exchanger cleaning can easily exceed \$100,000. In addition, the acid dissolves ship's materials potentially reducing the system's service life.

On a few DoD vessels, electro-chlorination is used to retard fouling. Use of the technology results in free chlorine release into the ocean. Free chlorine, a halogen, may present a problem in

that it can affect photosynthesis of marine organisms. At present, the Clean Water Act limits chlorine release within 200 nautical miles of shore to between 7.5 and 13 parts per billion (ppb). Proposed standards as part of the Uniform National Discharge Standards may further limit release within 12 nautical miles of the United States shoreline. The current standard chlorine dosing level for Navy ships is 200 ppb for two hours a day as a minimum to control bio-fouling.

The Basics About ESTCP

THE ENVIRONMENTAL SECURITY Technology Certification Program is DoD's environmental technology demonstration and validation program. The program was established in 1995 to promote the transfer of innovative technologies that have successfully established proof of concept to field or production use. ESTCP demonstrations collect cost and performance data to overcome the barriers to employ an innovative technology because of concerns regarding technical or programmatic risk.

The program's goal is to identify and demonstrate the most promising innovative and cost-effective technologies and methods that address DoD's high-priority environmental requirements. Projects conduct formal demonstrations at DoD facilities and sites in operational settings to document and validate improved performance and cost savings. To ensure the demonstrated technologies have a real impact, ESTCP collaborates with end users and regulators throughout the develop-

ment and execution of each demonstration. Transition challenges are overcome with rigorous and well-documented demonstrations that provide the information needed by all stakeholders for acceptance of the technology.

ESTCP issues an annual solicitation for proposals from the Federal government, academia, and industry and employs a competitive selection process to ensure that ESTCP funds high-quality demonstrations. ESTCP requires each project to develop a formal test and evaluation plan. Demonstration results are subject to rigorous technical reviews to ensure that the conclusions are accurate and well supported by data.

ESTCP is managed by a Director and Deputy Director, five Program Managers, and a Financial Officer. The ESTCP office is co-located with the Strategic Environmental Research and Development Program (SERDP) in Alexandria, Virginia. In this joint program structure, the management staff has insight into the entire range of scientific and technical issues associated with an

environmental problem, from basic research questions through implementation. ESTCP relies on the technical skills offered by the participating Services serving on its technical committees to assist in the technical aspects of program development, project selection, program monitoring, and technology transfer.

ESTCP projects are managed within the following five program areas:

1. Energy and Water
2. Environmental Restoration
3. Munitions Response
4. Resource Conservation and Climate Change
5. Weapons Systems and Platforms

For more information, visit the program's web site at www.serdp-estcp.org.





Pier-side sewer connection
at NAVSTA Mayport.

A Different Halogen & Method

To extend the periods in between cleanings, while maintaining optimal functionality and thus improving the elemental and functional impact of fouling heat exchangers, a recent NAVFAC EXWC project sponsored by ESTCP and the Navy Environmental Sustainability Development to Integration (NESDI) program demonstrated the suitability of iodine bubble infusion technology. This technology, a proprietary product of I2 Air Fluid Innovation, Inc., utilizes a low volume of elemental iodine (I2) vapor eluted from iodine coated resin beads in an air stream and delivers that vapor via bubbles to the heat transfer surfaces on the seawater side of shipboard heat exchangers. This technology uses microbial interactions to provide a targeted disinfection without the need for treating the entire water volume. The iodine inactivates the fouling microorganisms and thus helps to prevent both the formation of a bio-film and subsequent macro fouling. Through the infusion of air containing elemental iodine vapor into the heat exchanger, this demonstration has shown that the formation of biological foul can be reduced and the period between physical cleanings extended while maintaining acceptable system parameters.

Elemental iodine is a halogen that acts similar to chlorine in its ability to inactivate fouling microbes but with less environmental impact. When iodine is found in both the ocean water and sea life and when newly introduced, rapidly degrades into already present compounds. The method of introduction, as a vapor filled bubble, can offer additional safety, environmental, effectiveness and economic benefits as well.

Effectiveness of the Iodine Bubble Infusion Technology

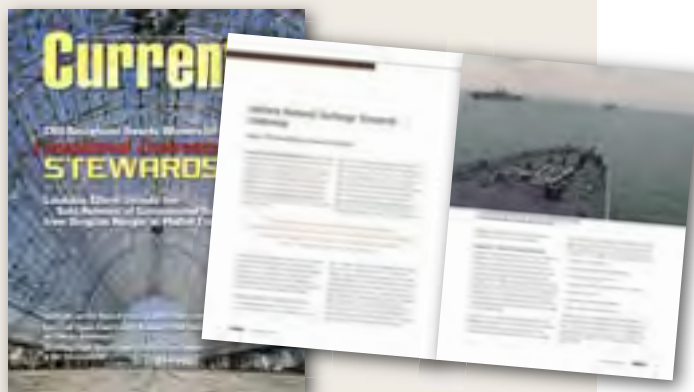
The ESTCP-sponsored demonstration showed that the I2 bubble infusion technology can increase the period

between cleanings while maintaining system efficiencies. Additionally, the project showed that infused iodine bubbles as part of an in situ cleaning method, reduces cleaning time, the generation of acidic liquid waste, and heat exchanger maintenance costs. The I2 bubble infusion technology has also undergone proof of concept laboratory testing against microbial challenges in other studies. In a Cornell University study sponsored by the United States Department of Agriculture, it has been shown to reduce microbe concentration levels by seven orders of magnitude within 90 seconds in fluids. Studies at Washington State University have shown the technology to be effective in reducing microbes in turbid water and beneath bio-films.

In 2007, the I2 bubble infusion technology had its first commercial implementation. It was used on a fouled industrial geothermal heat exchanger at Standard Microsystems, an electronics technology manufacturing facility located in Hauppauge, New York. Between 2009 and 2010, several other commercial implementations

For More Insights

FOR MORE INSIGHTS into the reducing the environmental impact of has been a priority of Navy's afloat environmental program for decades. In recent months, the Navy and the U.S. Environmental Protection Agency (EPA) have made great strides toward implementing new nationwide standards for liquid discharges from Navy ships, read our article "Uniform National Discharge Standards Underway: Navy & EPA Make Progress Toward Final Rules" in the summer 2014 issue of *Currents*. You can browse the *Currents* archives at the Department of the Navy's Energy, Environment and Climate Change web site at <http://greenfleet.dodlive.mil/currents-magazine>.



were completed including the first salt water application for a site in Bermuda. In all instances, I2 infusion was able to retard the formation of foul within previously rapidly fouling heat exchangers.

A Logical Approach

Regardless of the existence of shipboard electro-chlorination systems, heat exchangers are periodically taken out of service and cleaned by an expensive mechanical or chemical cleaning method. This work is almost always performed while the ship is in port. The period between cleanings depends on the ship's operating tempo and area of operation. Those ships operating in warm water require more frequent cleaning. The overall goal of this demonstration project was the rehabilitation of an already fouled exchanger and a reduction in foul progression under normal operating conditions.

For the technology to be considered useful, and paramount to the success of this study, the project team determined that four important criteria needed to be met:

1. System safety
2. Ease of use and integration
3. Environmental safety
4. Effectiveness in retarding the progression of bio-fouling

To address these criteria, the project was completed in three phases:

1. Laboratory testing
2. Field testing
3. Shipboard demonstration

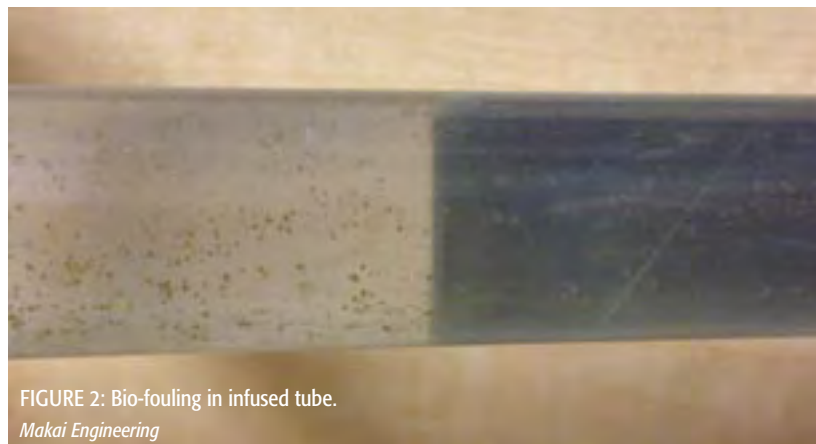
Phase 1: Laboratory Testing

In the first phase, the team verified that the non-metallic and metallic materials commonly used within shipboard heat exchangers were compatible with the chemicals used during the I2 protocols. These laboratory tests also verified that the iodinated bubbles did not increase the erosion rate on heat exchanger materials.

Phase 2: Field Testing

Field testing was performed at the National Energy Laboratory of Hawaii Authority's (NELHA) facility in Kona, HI to determine foul retardation and metal erosion rates for five common heat exchanger metals

using warm Pacific Ocean seawater. Testing was performed both in unlit conditions, emulating the heat exchanger interior, and sunlight conditions fostering the growth of algae. Testing showed that the I2 infusion process was not inhibitory to algae growth. Although initial qualitative indications showed a reduction the formation of fouling (see Figures 1 & 2 below), numerous performance problems prevented the completion of this testing.



Phase 3: Shipboard Demonstration

Onboard the Self Defense Test Ship (SDTS), homeported in Port Hueneme, California, two identical Low Pressure Air Compressor (LPAC) heat exchangers (numbers 1 and 2), were used for the demonstration. At the start of the demonstration, both exchangers were chemically cleaned using the I2 protocol to establish an identical baseline.

LPAC No. 1 was designated to receive the infusion protocol. The I2 infusion equipment was installed in a



The number 1 LPAC heat exchanger onboard the SDTS.

Bruce Holden



The I2 bubble infusion device.

Bruce Holden

small box mounted above the heat exchanger. The demonstration was performed over a period exceeding nine months, with resin cartridges changed approximately monthly. No equipment maintenance was required during the demonstration period. Daily measurements of the

inlet and outlet temperatures and inlet pressure readings were recorded on calibrated ship's gauges. These measurements were used to determine the degree of bio-fouling. Periodic water samples were obtained to measure metallurgical elution (dissolved metal content) and

Although the project team had wanted each exchanger to be used 50 percent of the time, in actuality, LPAC No. 1 was in use approximately 85 percent of the time. As expressed by the crew, typically this exchanger would have been cleaned every three to six months.



This photo of the internal heat exchanger tubing in LPAC No. 1 was taken at the conclusion of the demonstration of the I2 bubble technology, shows dirty, but not bio-fouled tubing.

Bruce Holden

sublimation of iodine (in gaseous form). Measuring the amount of metallurgical elution was used to confirm that the protocol did not excessively strip metallic ions from the heat exchanger surfaces which could reduce its service life. Sublimation of iodine measurements served to confirm that iodine discharges would be minimal and given iodine's presence in seawater and marine plant life, present an insignificant ecological risk.

At the end of the demonstration, the temperature and pressure parameters were still within the acceptable range. Water sampling indicated low metal and iodine levels within the effluent. LPAC No. 1 metal ion elution did not vary greatly whether the system was infusing or not. At the end of the demonstration period, the LPAC units were disassembled and viewed for foul progression. The inspection showed that the tubes were relatively clear of solidified foul.

Unfortunately, this project did not result in a definitive and clear indication of success. The fact that the LPAC No. 1 exchanger was used 85 percent of the time meant the control heat exchanger (LPAC No. 2) saw very little

use. Ideally, the demonstration would have been continued until such time that the ship needed to perform a heat exchanger cleaning. Since the ship normally cleans the exchangers every three to six months, investigators were, however, able to demonstrate that the I2 bubble infusion technology achieved the project's most important goal—extending the period between cleanings by 50 percent. For additional project results, see ESTCP Final Report TR-NAVFAC-EXWC-EV-1404 posted on the ESTCP web site at [www.serdp-estcp.org/Program-Areas/Weapons-Systems-and-Platforms/Waste-Reduction-and-Treatment-in-DoD-Operations/WP-201219/WP-201219/\(language\)/eng-US](http://www.serdp-estcp.org/Program-Areas/Weapons-Systems-and-Platforms/Waste-Reduction-and-Treatment-in-DoD-Operations/WP-201219/WP-201219/(language)/eng-US).

Ongoing Research

Even with the limited indication of success, two follow-on Navy demonstrations of this technology have been initiated. The technology underwent further study at the Undersea Naval Warfare Center in Newport, Rhode Island as a hull foul retardant in conjunction with air bubble curtains between the spring and fall of 2014. Early observations indicated an inhibitory effect on the



growth cycle of some fouling species and on the surface bonding capabilities of barnacles. Water sampling analysis indicated no change in sea water iodine levels during full iodine infusion compared to ambient sea water. Complete demonstration results should be available in the near future.

The technology is also the subject of investigation through the NESDI program. The NESDI program has just launched a project (Bio-fouling Reduction of Ship Cooling Water Systems (project no. 502)) to study the retardation of fouling within a support system heat exchanger used to replace a submarine's heat exchanger while the submarine is undergoing maintenance in a dry dock.

Although not approved at this time, the project team's is working to get the technology demonstrated on a Navy combat ship with the demonstration period long enough to determine how long the I2 technology can extend the period between heat exchanger cleanings. ⚓

The Basics About the NESDI Program

THE NESDI PROGRAM seeks to provide solutions by demonstrating, validating and integrating innovative technologies, processes, materials, and filling knowledge gaps to minimize operational environmental risks, constraints and costs while ensuring Fleet readiness. The program accomplishes this mission through the evaluation of cost-effective technologies, processes, materials and knowledge that enhance environmental readiness of naval shore activities and ensure they can be integrated into weapons system acquisition programs.

The NESDI program is the Navy's environmental shoreside (6.4) Research, Development, Test and Evaluation program. The program is sponsored by the Chief of Naval Operations Energy and Environmental Readiness Division and managed by the Naval Facilities Engineering Command out of the Naval Facilities Engineering and Expeditionary Warfare Center in Port Hueneme, California. The program is the Navy's complement to the Department of Defense's Environmental Security Technology Certification Program which conducts demonstration and validation of technologies important to the tri-Services, U.S. Environmental Protection Agency and Department of Energy.

For more information, visit the NESDI program web site at www.nesdi.navy.mil or contact Ken Kaempffe, the NESDI Program Manager at 805-982-4893, DSN: 551-4893 or ken.kaempffe@navy.mil.



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Hawaii Takes to the Air for Oil Spill Response

Partnering with the Local Community Increases the Navy's Oil Spill Response Capabilities

PERSONNEL FROM VARIOUS commands within Navy Region Hawaii are training to become aerial observers during major oil spill responses.

Recent catastrophic oil spills, such as those in San Francisco Bay and the Gulf of Mexico, demonstrated serious and long-lasting impacts that a spill can impose on the environment and the community. Dead fish, oiled

plans have already identified their response organizations, equipment, oil recovery tactics and disposal facilities. During an actual response, the spill management team can use oil spill trajectory models to predict where the oil might go, enabling responders to preposition crews and equipment to clean up the oil. However, knowing exactly where the oil is located can be challenging.

or in the event of an actual spill. This need was driven in part by the presence of the Navy's defense fuel support point at Naval Supply Systems Command Fleet Logistics Center Pearl Harbor (NAVSUP FLC Pearl Harbor). This facility is the largest bulk fuel storage and handling facility in the central Pacific Ocean and manages millions of gallons of fuel. Fueling operations for vessels at

Although large spills rarely occur, preparedness and compliance with regulations is extremely important.

birds and injured marine mammals are just some of the potential impacts of a large oil spill. People who live, work or play near a spill site can also experience hazardous exposures to petroleum vapors. Economic impacts can devastate the local community when tourists cancel their reservations or loss of important fishing areas results in high unemployment.

Because of these impacts, it is imperative that any response to a spill be as effective and efficient as possible. Navy facilities with oil spill response

Standing on the beach can only tell you so much. Even if you send someone up in a helicopter, he or she can easily mistake cloud cover, channels through the reefs, or schools of fish for an oil slick.

Hawaii's sensitive marine environment and an economy dependent on the preservation of that environment could be threatened by an uncontrolled oil spill. To address these risks, Navy Region Hawaii recognized the need to develop its own cadre of trained aerial observers to engage during a spill response drill

Pearl Harbor and aircraft at Hickam Field happen almost daily. Although large spills rarely occur, preparedness and compliance with regulations is extremely important.

To close this critical data gap, federal regulations (specifically "Response plan development and evaluation criteria for facilities that handle, store, or transport Group I through Group IV petroleum oils" (33 CFR 154.1045(j))) were revised in 2011 to address the need for aerial observers. (Note: See our sidebar "Basic Stock Categories" for more insights into the

groupings of petroleum oils.) These regulations require facilities handling, storing, or transporting Group I through Group IV petroleum oils that they “must identify in the response plan, and ensure the availability through contract or other approved means, of response resources necessary to provide aerial oil tracking to support oil spill assessment and cleanup activities.” The regulation further describes the minimum training that these aerial observers must receive.

Navy Region Hawaii has a memorandum of agreement for training with the Clean Islands Council—a local oil spill response cooperative. (For more information about the Clean Islands Council, visit <http://cleanislands.com>.) The aerial observer program is just one of many programs which the Council’s general manager Kim Beasley developed to support the many member companies and agencies that make up the council. And, according to Mr. Beasley, even though the aerial observer program has been on the books for a few years, many locales are just beginning to train their aerial observer teams. In addition to organizing classroom and flight training, Beasley developed a process for observers to record their flight—from the actual flight path tracing to linking photographs taken from the air to that flight path track.



The Navy Region Hawaii aerial observer team stands in front of the helicopter that will take them on their training flight. FROM LEFT: Steve Butler, Estra Higa and Cynthia Pang.

Kirk Tomita

A Better Oil Spill Trajectory Model

TO IMPROVE THE science of determining oil spill trajectories in Hawaii and elsewhere, Pei-fang Wang of the Space and Naval Warfare Systems Command, Systems Center Pacific has combined two predictive models under an effort sponsored by the Navy Environmental Sustainability Development to Integration (NESDI) program.

Up until recently, the National Oceanic and Atmospheric Administration’s (NOAA) model, known as GNOME (General NOAA Operational Modeling Environment) has been the standard model for use as a first response to an oil spill event. However, GNOME is a transport model and not a hydrodynamic model, meaning that GNOME does not compute currents but relies on data from an external source. To address this deficit, this project team combined the GNOME model with the Navy’s Curvilinear Hydrodynamics in 3-dimensions (CH3D).

The linked model uses the best parts of each model, including the oil properties and transport prediction in GNOME and the accurate hydrodynamic calculations, including currents and water mass movement in fine resolutions from CH3D. The linked model has been demonstrated to improve the predictive accuracy of oil spill trajectories for Pearl Harbor and San Diego Bay.

For more information about the NESDI program, visit the program’s web site at www.nesdi.navy.mil or contact Ken Kaempffe, the NESDI Program Manager at 805-982-4893, DSN: 551-4893 or ken.kaempffe@navy.mil.





Aerial observers might need to fly close to the shoreline to check for signs of oil. Observers also look for sea turtles, seals and other wildlife along the shore that could be potentially impacted by the oil.

Cynthia Pang

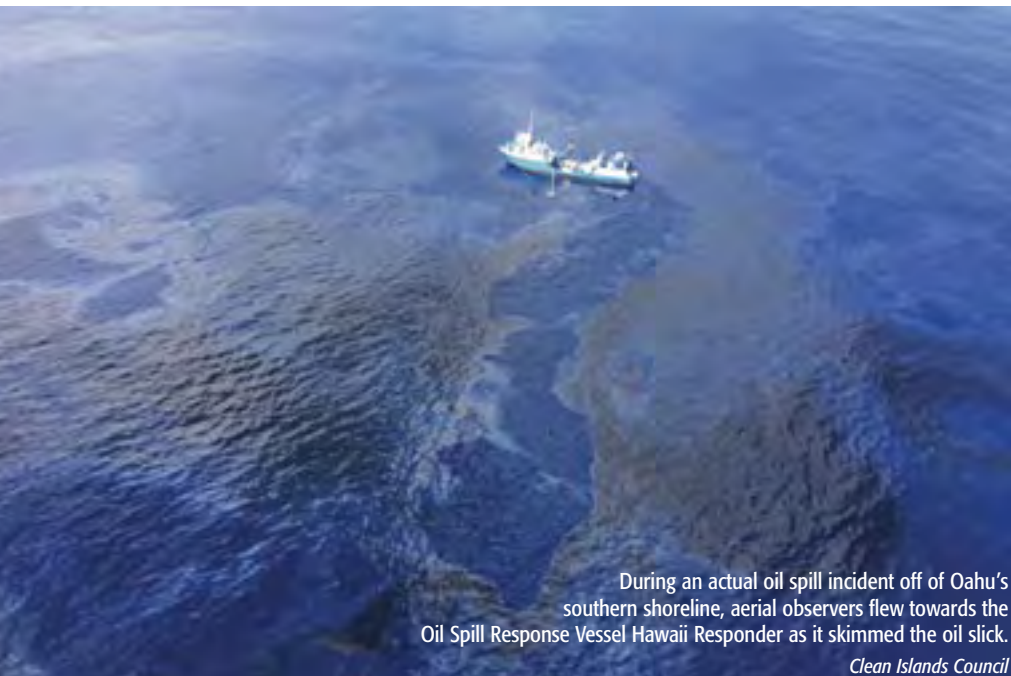
In 2011, Navy Region Hawaii designated three Navy civilians to begin training to become qualified aerial observers. Cynthia Pang (Navy Region Hawaii), Steve Butler (NAVSUP FLC Pearl Harbor), and Estra Higa (Naval Facilities Engineering Command Hawaii) underwent initial training in a

commercial helicopter. This was followed by training on using oil spill tracking software to record their flights on maps. Following this initial training, the trio also participated in a joint Navy and private industry worst-case-discharge scenario oil spill exercise. This exercise involved an

off-shore oil spill scenario and was used as a practical training exercise for the aerial observers. The team flew in a chartered helicopter over the exercise site and along the shoreline.

Each aerial observer is expected to spot oil, clean areas and endangered wildlife. They also learn how to work in the command post interpreting data and preparing presentation materials.

Aboard the helicopter, the Navy observers use a laptop computer connected to a global positioning system device to record the complete flight path and perform other tasks, such as charting the exact location of the spill and its boundaries. Hardware aboard the helicopter transmits the information immediately to the incident command post. Once the data are received, another qualified observer estimates the area of the oil slick using software in the command post and quickly prepares briefing material using the overflight track and photos taken during the aerial surveillance. This provides the Unified Command as well as the spill



During an actual oil spill incident off of Oahu's southern shoreline, aerial observers flew towards the Oil Spill Response Vessel Hawaii Responder as it skimmed the oil slick.

Clean Islands Council

The data obtained by the aerial observers provide much needed information to the Unified Command, enabling them to make the right decisions.

—Cynthia Pang

management team with valuable information that can be used to project movement of the oil, develop cleanup plans, send people out to rescue animals, and take other necessary actions.

In the “old days”, the helicopter had to land first and someone had to drive to the command post with the data. Using the new process and equipment, Unified Command members can have immediate access to the data and a clear understanding of the situation as soon as changes occur.

With new technology, the program was updated and training was completed in September 2014. At that time, the trio was able to complete their observer training with classroom instruction on the science of oil spills, physical properties of petroleum, aerial oil slick pattern recognition, conversion of raw data into visual presentation materials and other relevant topics. The team also flew in a helicopter as a refresher and to complete that phase of their training while learning additional skills on an iPad and global positioning software.

As a final part of its training, the Navy observer team participated in a major local industry-led oil spill exercise. They took turns with other observers from industry at the command post and in the air. Using their observations about the oil spill, its location, endangered species in the area and other valuable information, the Unified Command and the spill

management team developed tactics to efficiently remove the oil and prevent environmental damage. Without aerial observers, only very limited visual observation from the shore would be available.

In October 2014, an actual oil spill occurred south of Barbers Point on the island of Oahu. This was a relatively small spill from a local industry and was less than 2,000 gallons of

an oily-water mixture. However, it posed a potential threat to marine life. Pang was able to put her training into actual practice when she partnered with the Clean Islands Council in the response. She was assisted at the command post while other aerial observers from local industry flew over the site. She converted their raw data and overflight photographs into presentation materials for the Unified Command. This helped greatly to

Basic Stock Categories

A **BASE STOCK** is a lubricant component that is produced by a single manufacturer to the same specifications (independent of feed source or manufacturer's location); that meets the same manufacturer's specification; and that is identified by a unique formula, product identification number, or both.

All base stocks are divided into five general categories:

- Group I base stocks contain less than 90 percent saturates and/or greater than 0.03 percent sulfur and have a viscosity index greater than or equal to 80 and less than 120 using specified test methods.
- Group II base stocks contain greater than or equal to 90 percent saturates and less than or equal to 0.03 percent sulfur and have a viscosity index greater than or equal to 80 and less than 120 using specified test methods.
- Group III base stocks contain greater than or equal to 90 percent saturates and less than or equal to 0.03 percent sulfur and have a viscosity index greater than or equal to 120 using specified test methods.
- Group IV base stocks are polyalphaolefins (PAO). PAOs can be interchanged without additional qualification testing as long as the interchange PAO meets the original PAO manufacturer's specifications in physical and chemical properties.
- Group V base stocks include all other base stocks not included in Group I, II, III, or IV.

Source: The American Petroleum Institute (www.api.org)

Due to its location in the middle of the Pacific Ocean and the large quantity of oil stored and handled, oil spill prevention and response preparedness are high priorities for Navy Region Hawaii.

understand the scope and movement of the oil slick. Through this experience, Pang put her “lessons learned” regarding creating situation maps and other data into an aerial observer job aid to assist the others on the Navy team should they be mobilized for an oil spill.

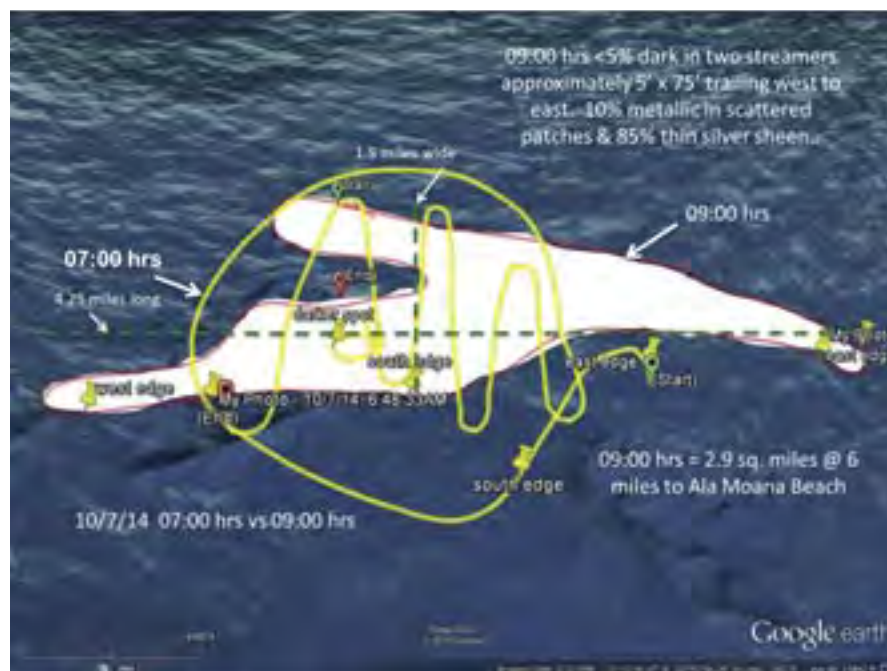
“This has been a great experience,” said Pang. “The data obtained by the aerial observers provide much needed information to the Unified Command, enabling them to make the right decisions. The technology improvements allow them and the rest of the spill management team to see what is happening immediately.

Without a strong aerial observation team, we would be essentially guessing where the oil is and where the slick is heading.”

Butler said, “In addition to knowing where the oil is, it’s also very important to know where it isn’t. There may be folks who may later claim that they were impacted by the oil. So these overflights are essential for documenting the boundaries of the spill.”

Higa added, “The information being gathered is crucial and very important for an efficient response. We need to know where the oil is, how much is out there and where it’s going. I look forward to additional training to become even more proficient.”

Due to its location in the middle of the Pacific Ocean and the large quantity of oil stored and handled, oil spill prevention and response preparedness are high priorities for Navy Region Hawaii. The Region’s spill management



In this documentation from an actual oil spill, the yellow line represents the oil slick outline during the 7 a.m. overflight. The red line represents the 9 a.m. overflight. The change in shape is very apparent. The white area shows the oil estimated to be 2.9 square miles in size.

Clean Islands Council

team often attends incident command system training and participates in various exercises. This allows the team members to meet, work and partner with members from the private sector and government officials from federal, state and county level.

To meet the requirement for aerial observers, Navy Region Hawaii was able to draw upon its tenant commands to form its own team. By training with other governments and private industry, Navy Region Hawaii and its partners in the local community ensures that the response is timely, effective and well-coordinated. ⚓

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